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The Engineer

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PUBLIC NOTICES

Civil Engineer Required by the GOVERNMENT of HONG KONG for three years' service as an ASSISTANT ENGINEER in the PUBLIC WORKS DEPARTMENT, with prospects of permanency. Salary £400 a year, rising by annual increments of £20 to £600 a year, with temporary addition of exchange allowance. Free passages provided.

2. Candidates, unmarried, 25 to 30 years of age, must be Associate Members of the Institution of Civil Engineers, who have had experience on the construction of waterworks and in the use of concrete. Preference will be given to candidates who have been trained in a Waterworks Engineer's Office.—Apply at once, in writing, stating age and brief details of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/Hong Kong 11,012. 6368

Civil Engineer Required by the GOVERNMENT of ST. VINCENT, BRITISH WEST INDIES, for service as COLONIAL ENGINEER for three years, with prospect of permanent and pensionable employment. Salary £350 per annum, rising by annual increments of £25 to £400 per annum, with a travelling allowance of £60 per annum. Free first-class passages. Good climate and moderate cost of living. Quarters not provided.

Candidates must be Civil Engineers and Surveyors, trained and experienced in the construction of roads, culverts, small bridges, public buildings, jetties, &c., preferably with experience in the Royal Engineers.—Apply at once, in writing, stating age and brief details of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W.1, quoting M/St. Vincent 11,007. 6369

The Institution of Mechanical Engineers,
STOREY'S GATE, WESTMINSTER, S.W. 1.

ELEVENTH REPORT TO THE ALLOYS RESEARCH COMMITTEE ON SOME ALLOYS OF ALUMINIUM.

By WALTER ROSENHAIN, B.A., D.Sc., F.R.S., SYDNEY L. ARCHBUTT, F.I.C., and D. HANSON, D.Sc.

(230 pp., 24 Plates, 92 Figs. in letterpress. Price £2 2s.)

This Report will be discussed at the General Meetings on 21st and 28th October, at 6 p.m. 6329

UNIVERSITY OF LONDON.

King's College.
SPECIAL ADVANCED ENGINEERING LECTURES.

The following SPECIAL ADVANCED LECTURES have been arranged for post-graduate and other advanced Students :—

FIRST TERM.

1. "Liquid Fuels" (a Course of Five Lectures), by HAROLD MOORE, M.Sc. Tech., F.C.S., M. Inst. Pet. Tech.

Alternate Mondays, at 5.30 p.m., commencing October 17th, 1921.

2. "Liquid Fuel Engines" (a Course of Five Lectures), by W. R. ORMANDY, D.Sc., F.C.S., M.I.Auto.E.

Alternate Mondays, at 5.30 p.m., commencing October 24th, 1921.

3. "Bridge Construction" (a Course of Five Lectures), by H. W. FITZSIMONS, B.Sc., A.M. Inst. C.E.

Alternate Thursdays, at 5.30 p.m., commencing October 13th, 1921.

4. "Cascade Induction and Synchronous Motors and Generators" (a Course of Five Lectures), by L. J. HUNT, M. Inst. C.E., M.I.E.E.

Tuesdays, at 5.30 p.m., commencing October 18th, 1921.

S. T. SHOVELTON, M.A., Secretary.

6330

Artillery College, Woolwich.

DEPARTMENT OF MECHANICAL AND ELECTRICAL ENGINEERING.

PROFESSOR: Mr. J. J. GUEST.

APPLICATIONS are INVITED for the POSTS of :—

JUNIOR LECTURER. Salary £400 p.a. to £500 p.a.;

DEMONSTRATOR. Salary £300 p.a. to £400 p.a.; in the Mechanical Engineering Section.

Posts pensionable under the Federated Superannuation Scheme for Universities.

The Junior Lecturer preferably should have had experience in Internal Combustion Engine Work.

Applications should be made in writing to—

THE COMMANDANT,
Artillery College,
Red Barracks,
Woolwich, S.E. 18,

from whom further particulars may be obtained. 6275

Portsmouth Municipal College.

MECHANICAL AND CIVIL ENGINEERING DEPARTMENT.

PRINCIPAL: OLIVER FREEMAN, Wh.Sc., A.R.C.S., B.Sc.

HEAD OF DEPARTMENT: E. C. PRESCOTT, M.Sc. (Tech.), A.M.S.T.

APPLICATIONS are INVITED for the APPOINTMENT of a LECTURER in MECHANICAL ENGINEERING. Salary according to the Burnham Committee's Scale. Further particulars and forms of application may be obtained from the undersigned, to whom applications should be returned at once, accompanied by copies only of not more than three recent testimonials.

H. E. CURTIS, Secretary.

Offices for Higher Education, The Municipal College, Portsmouth. 6292

The National Foremen's Association of the ENGINEERING AND ALLIED TRADES.

(Registered under the Trade Union Act.)

An Association specifically formed to look after the interests of Foremen in their Supervisory Capacity.

All communications to Head Office,
H. W. REID, 95, Belgrave-road,
General Secretary. Victoria, S.W. 1.

PUBLIC NOTICES

Calcutta Electric Supply Corporation, Ltd.

The Directors of the Calcutta E.S. Co. invite TENDERS for the following PLANT, to be delivered and erected at their Generating Station at Cossipore, Calcutta :—

SPECIFICATION No. 70.—ONE 15,000 K.W. TURBO-ALTERNATOR and CONDENSING PLANT.

SPECIFICATION No. 71.—TWO WATER-TUBE BOILERS with an evaporation of 60,000 lb. per hour each.

The above specifications can be seen at and obtained from the offices of the Consulting Engineers, Messrs. Kennedy and Donkin, 17, Victoria-street, London, S.W. 1, on and after Wednesday next, the 12th instant. Tenders are to be sent in by November 9th, 1921.

IVOR C. THOMAS, Secretary.

2 and 4, Clement's-inn, Strand, W.C. 2, 5th October, 1921. 6373

City of Leeds.

TO ELECTRICAL ENGINEERS AND OTHERS.

The Health Committee invite TENDERS for the SUPPLY and ERECTION of an ELECTRIC LIGHTING SET, comprising 4 B.H.P. Oil Engine, 3 K.W. D.C. Generator, and Accumulators, complete with Tanks, Piping, Switchboard, &c., at the Leeds Sanatorium, Gateforth, near Selby. Copies of the specification, giving full particulars, may be had on application at the Town Clerk's Office, 26, Great George-street, where Tenders, endorsed "Electric Lighting at Gateforth," are to be delivered by the 18th inst.

ROBERT E. FOX, Town Clerk.

October 1st, 1921. 6322

City of Leeds.

WATERWORKS DEPARTMENT.

The Waterworks Committee of the Leeds Corporation invite TENDERS for the DESIGN and CONSTRUCTION of an ELEVATED WATER-TIGHT REINFORCED CONCRETE TANK and PUMP-HOUSE at Moortown, Leeds.

Forms of Tender, conditions of contract, and specifications may be obtained from the Waterworks Engineer, Leeds, on payment of a fee of £1, which will be returned on receipt of a bona fide Tender for the work.

Tenders, enclosed in a sealed envelope, endorsed "Tender for Moortown Tank," must be addressed to the Chairman of the Waterworks Committee, Town Clerk's Office, Park-square, Leeds, and delivered not later than 10 a.m. on the 14th of November, 1921.

The Committee does not bind itself to accept the lowest or any Tender.

CHARLES G. HENZELL, M. Inst. C.E., Waterworks Engineer.

26, Great George-street, Leeds, 1st October, 1921. 6321

Corporation of Durban, Natal.

The Corporation of Durban, Natal, is prepared to receive TENDERS for the SUPPLY and DELIVERY "Free on Board" (or C.I.F. Durban, if convenient) of 4 MILES SINGLE TRAM TRACK complete with bonds, to be approved by the Representative Engineers, Messrs. W. H. Radford and Son, Albion Chambers, Nottingham.

Specifications by Mr. E. F. Davis, Borough Engineer, Durban, can be obtained from, and sealed and endorsed Tenders must be delivered to, the undersigned on or before the 21st October, 1921.

The lowest or any Tender will not necessarily be accepted.

Applications for specification must be accompanied by a deposit of £2 2s., which will be returned on receipt of bona fide Tender.

By Order,
WEBSTER, STEEL and CO.,
5, East India-avenue,
Leadenhall-street, London, E.C.,
Agents to the Durban Corporation.

6344

PUBLIC NOTICES

Edinburgh Corporation Electricity Supply.

The Lord Provost, Magistrates and Council invite TENDERS for the following WORK :—

SPECIFICATION No. 38.—FOUR 10-15 TONS HAND-OPERATED OVERHEAD TRAVELLING CRANES.

A copy of the specification and drawings can be obtained from the office of Sir Alexander Kennedy, 17, Victoria-street, Westminster, S.W. 1 (on or after the 7th October). An additional copy of the specification can be obtained if required.

Tenders, on the prescribed form, enclosed in sealed envelopes and addressed on the outside "Electricity Supply Tender to Specification No. 38," must be delivered at the office of the undersigned not later than 18th October, 1921, at 10 a.m.

The Council do not bind themselves to accept the lowest or any Tender.

A. GRIERSON, S.S.C., Town Clerk.

City Chambers, Edinburgh, 4th October, 1921. 6359

Edinburgh Corporation Electricity Supply, PORTOBELLO STATION.

The Lord Provost, Magistrates and Council invite TENDERS for the following WORK :—

SPECIFICATION No. 39.—ELECTRIC AND STEAM-DRIVEN FEED PUMPS.

A copy of the specification can be obtained from the office of Sir Alexander Kennedy, 17, Victoria-street, Westminster, S.W. 1, on or after the 7th October.

Tenders, on the prescribed form, enclosed in sealed envelopes and addressed on the outside "Electricity Supply, Tender to Specification No. 39," must be delivered at the office of the undersigned not later than 18th October, 1921, at 10 a.m.

The Council do not bind themselves to accept the lowest or any Tender.

A. GRIERSON, S.S.C., Town Clerk.

City Chambers, Edinburgh, 4th October, 1921. 6360

The Great Indian Peninsula Railway Company.

The Directors are prepared to receive TENDERS for the SUPPLY of the following STORES, namely :—

No.		Specification fees.
1.	STEEL WORK for BRIDGES	10s.
2.	STEEL TYRES for CARRIAGES and WAGONS	10s.
3.	INDIA-RUBBER HOSE PIPES, SHOOTS, &c.	7s. 6d.
4.	SHEFFIELD TOOLS, &c.	5s.
5.	CARRIAGE DOOR HANDLES, HINGES, &c.	7s. 6d.
6.	BOLTS, NUTS, RIVETS, &c.	10s.
7.	STATION BELLS, BIB COCKS, &c.	5s.
8.	MILD STEEL BARS, SECTIONS, &c., for Miscellaneous Purposes	10s.
9.	STATIONERY, &c.	10s.

Specifications and forms of Tender may be obtained at this office on payment of the fee for the specification, which payment will not be returned.

The fee should accompany any application by post. Cheques and postal orders should be crossed and made payable to the Great Indian Peninsula Railway Company.

Tenders must be delivered in separate envelopes, sealed and addressed to the undersigned, marked "Tender for Steel Work for Bridges," or as the case may be, not later than Eleven o'clock a.m. on Tuesday, the 18th October, 1921.

The Directors do not bind themselves to accept the lowest or any Tender.

R. H. WALPOLE, Secretary.

Company's Offices, 48, Copthall-avenue, E.C. 2, London, 5th October, 1921. 6372

PUBLIC NOTICES

The Proprietor of Letters Patent No. 20,794/1914, relating to INTERNAL COMBUSTION ENGINES, DESIRES to DISPOSE of his PATENT or to GRANT LICENCES to interested parties on reasonable terms with a view to the adequate working of the patent in this country.—Enquiries to be addressed to CRUIKSHANK AND FAIRWEATHER, 65-66, Chancery-lane, London, W.C. 2. 6336

The Proprietors of Letters Patent No. 12,254/1913, relating to MEANS FOR COOLING THE FUEL NOZZLES OF INTERNAL COMBUSTION ENGINES, DESIRE to DISPOSE of their PATENT or to GRANT LICENCES to interested parties on reasonable terms with a view to the adequate working of the patent in this country.—Enquiries to be addressed to CRUIKSHANK AND FAIRWEATHER, 65-66, Chancery-lane, London, W.C. 2. 6341

County Borough of Wallasey.
SEACOMBE FERRY IMPROVEMENTS.

The Corporation of Wallasey invite TENDERS for the CARRYING OUT of that portion of the above work denominated work "B," NEW FLOATING ROADWAY, and work "C," CUT for NEW FLOATING ROADWAY, and works in connection therewith, in accordance with the detailed plans and specification of Messrs. Wilton and Bell, Consulting Civil Engineers, Westminster Chambers, 1, Crosshall-street, Liverpool, at whose office copies of the specification and drawings may be seen.

Contractors desiring to obtain copies of plans and specification and schedule of quantities may do so on payment of a fee of £2 2s. for each work, or of £3 3s. for the two works, which fees will not be returnable.

Tenders, on the form of Tender provided, must be delivered to the undersigned in a sealed envelope, endorsed "Tender for Seacombe Ferry Improvements, Works "B" and/or "C," not later than Twelve Noon, Saturday, November 5th, 1921.

GEO. LIVSEY, Town Clerk.

Town Hall, Wallasey, 7th October, 1921. 6357

The Bengal and North-Western Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY and DELIVERY of :—

(a) MATERIALS for the CONSTRUCTION of 30 BOGIE CARRIAGES.
(b) 120 PAIRS of WHEELS and AXLES.
(c) 240 AXLE-BOXES,

as per specifications to be seen at the Company's offices.

Tenders, addressed to the undersigned and marked "Tender for Bogie Carriages," or as the case may be, are to be lodged not later than Noon on Monday, the 24th day of October, 1921.

For Specification (a) a fee of £1 and (b) and (c) a fee of 10s. will be charged, which cannot under any circumstances be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
E. A. NEVILLE, Managing Director.

237, Gresham House, Old Broad-street, London, E.C., 5th October 1921. 6378

Watford Urban District Council.
WATERWORKS.

CONTRACT No. 14.—SERVICE RESERVOIR.

The Watford Urban District Council is prepared to receive TENDERS for the CONSTRUCTION of a COVERED SERVICE RESERVOIR at Merrihill, Bushey, having a capacity of two million gallons.

Persons desirous of contracting for the work may see the plans, specification, and form and conditions of contract upon application to the Engineer, Mr. D. Waterhouse, Council Offices, High-street, Watford.

The schedule of quantities, specification, and form of Tender may be obtained from the Engineer upon payment of a deposit cheque of £10 payable to the Watford Urban District Council, which will only be returned upon the receipt of a bona fide Tender and the specification supplied to him.

Sealed Tenders and schedule, addressed to the undersigned Clerk to the Council, endorsed "Service Reservoir, Contract No. 14," must be delivered under cover to me at Watford not later than Monday, October 31st, 1921.

The Council does not bind itself to accept the lowest or any Tender.

W. HUDSON, Clerk and Solicitor.

Council Offices, 14, High-street, Watford, September, 1921. 6358

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PUBLIC NOTICES

County Borough of Stoke-on-Trent.
ENGINEERING ASSISTANT, ELECTRICAL ENGINEER'S DEPARTMENT.
WANTED, as personal ASSISTANT to BOROUGH ELECTRICAL ENGINEER (St. Peter's Chambers, Stoke-on-Trent), from whom particulars can be obtained respecting duties, &c., energetic, well-trained, and capable ENGINEER, with full knowledge of modern Boiler-house and Turbo Plant, Design, Installation, and Operation. Salary £564 p.a., rising to £585 p.a. on new plant coming into commercial service. 6337

Ministry of Finance, Egypt.
SURVEY OF EGYPT.—GIZA.
APPLICATIONS are INVITED for the POST of MECHANIC to the above Department, at a salary of £E432 per annum plus £E128 war bonus, which latter is liable to cancellation.
Applicants should have a thorough knowledge of the maintenance of a 60 H.P. Crude Oil Engine and Dynamo and be able to effect running repairs to Lithographic Printing Machinery. Preference will be given to applicants having a practical knowledge of electricity, particularly in respect to winding small direct-current motor armatures, as the printing machinery is electrically driven.
Candidates should not be more than 35 years of age.
The appointment will be on contract for a period of 2 years. The successful candidate, if recruited in Europe, will receive £E50 in lieu of passage expenses both to and from Egypt at the beginning and end of the period of service.
Information with respect to terms of service and contract with the Egyptian Government may be obtained from the Inspecting Engineer to the Egyptian and Sudanese Governments, Queen Anne's Chambers, Broadway, Westminster, London, S.W. 1.
Applications, together with copies of recent testimonials and statement of qualifications, should be addressed to the SURVEYOR-GENERAL, Survey of Egypt, Giza (Mudiriya), Egypt. 6366

SITUATIONS OPEN

WANTED, a WORKING ENGINEER, to Take Charge of a Factory Plant in Leicestershire; must have had experience in the Upkeep of Steam Engines, Boilers, Electric Lighting Plant and General Machinery.—Write, stating age, wages, and particulars of previous employment, Box 167, c/o Mather and Crowther, Ltd., 10/13, New Bridge-street, E.C. 4. 6186 A

WANTED for Indian Galvanising Works, an ENGINEER (unmarried) as ASSISTANT MANAGER, with practical experience in the Manufacture of Galvanised Tanks, Buckets, Hollow-ware, and Light and Heavy Galvanised Work generally.—Write, stating age, experience, and salary required, to Z. W. 940, c/o Deacon's, Leadenhall-street, London. 6343 A

JUNIOR ASSISTANT CIVIL ENGINEER WANTED on contract in Far East. Technical college training essential and at least one year's experience outdoor public works desirable. Age from 23 to 28 years. Strict medical examination before appointment. Good salary with furnished quarters.—Write with particulars to A. C. E., c/o Messrs. A. W. Brown, 39, Tothill-street, London, S.W. 1. 6370 A

WORKS MANAGER.—Experienced ENGINEER REQUIRED to fill position. State age, qualifications, and salary required.—Address, P4162, The Engineer Office. P4162 A

WANTED, DRAUGHTSMAN, Fully Experienced leading hand, locomotive work, capable of checking drawings. State experience, age, and salary required.—Address, P4153, The Engineer Office. P4153 A

WANTED, Competent DRAUGHTSMAN, with thorough knowledge of Design and Construction of Large Water-tube Boilers, Coal Conveyors, and all necessary Equipment for large Steam Installations. Must be familiar with latest modern practice.—Address, stating age, experience, and salary required, 6376, The Engineer Office. 6376 A

DRAUGHTSMAN, Experienced in Complete Boiler and Power-house Pipe Arrangements, capable of taking own dimensions on site and carrying jobs through without supervision.—Write, stating experience, age, and salary required, AITON and CO., Ltd., Derby. 6382 A

DRAUGHTSMAN (Mechanical Engineer) REQUIRED, Midlands; experienced in Design, Lay-out, Quantities and Estimating for Steam Engines and Waterworks Pumping Machinery. State full particulars of experience, age, and salary required.—Address, 6379, The Engineer Office. 6379 A

MATERIAL SPECIFICATION DRAUGHTSMAN, used to reading drawings and getting out quantities. Must have had Drawing-office and Shop Experience.—Address, stating age, experience, and salary required, 6365, The Engineer Office. 6365 A

STRUCTURAL STEEL WORKS in London, Principally interested in steel roofs and light buildings, has VACANCY for DRAUGHTSMAN. Must be able to carry a job through from design to shipment. Experience with manufacturers in same line preferred. —Apply by letter, stating age, experience, and salary expected, P4161, The Engineer Office. P4161 A

TWO or THREE First-class DRAUGHTSMEN REQUIRED for Aeronautical Work. A wide engineering experience, including shop training, with some experience of aeroplane work necessary. When applying give full particulars of training, experience, and salary required.—Address, 6364, The Engineer Office. 6364 A

ONE FOREMAN PAINTER WANTED for Argentine Railway; must be accustomed to Locomotive, Carriage and Wagon Work and able to fix piecework prices. Commencing salary £550 per annum. Passage provided and agreement for three years. Applicants must be 30 to 35 years of age and must forward full particulars of experience.—Replies to be addressed to Box "W. B. A.," c/o Davies and Co., 95, Bishopsgate, E.C. 2. 6354 A

SITUATIONS WANTED

BUYING ENGINEER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an extraordinary wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT. Services will be available in two weeks' time. —Write, Z. M. 615, c/o Deacon's, Leadenhall-street, E.C. 3. 6342 B

CHIEF WORKS ENGINEER (Mechanical and electrical), with twenty years' experience amongst large works plants, DESIRES responsible APPOINTMENT. Salary about £650 p.a.—Write, "C. H. O.," c/o J. W. Vickers and Co., Ltd., 5, Nicholas-lane, London, E.C. 6284 B

CIVIL ENGINEER, 15 Years' Experience on Large contracts, accustomed to acting out and managing all classes of construction, reinforced concrete, steel, &c., experience in harbour work, tunnelling, railway construction and surveys, hydrographic work, petroleum boring, &c.—69, Cobham-road, Kingston, Surrey. P4145 B

CIVIL ENGINEER (22), A.C.G.I., B.Sc., Late R.E. officer, 9 months military exp'e, 13 months D.O. surveying, design steel and reinforced concrete, capable and energetic. Any capacity and mod. salary if prospects good.—Address, P4163, The Engineer Office. P4163 B

CONSTRUCTIONAL ENGINEER in Sole Charge of general constructional engineering works, Calcutta, DESIRES CHANGE of CLIMATE and RESPONSIBLE POSITION; 18 years' sound theoretical and practical experience in structural work of all kinds and mechanical engineering at home and India. Sound constitution. Open to engagement 1st February, 1922.—Address, P4139, The Engineer Office. P4139 B

THE CIVIL ENGINEERS' APPOINTMENTS BOARD.

(8, Princes Street, S.W. 1.—*Communications by letter only*).

Established in 1912 with the approval of the Council of The Institution of Civil Engineers.

Inquiries are invited from employers requiring the services of Professional Engineers or Professional Engineering Assistants.

The Board's Register of those seeking professional engineering appointments is open to all whose training, qualifications and experience have been approved by The Institution of Civil Engineers by election to Corporate Membership or admission to Studentship of that body.

The Board will also be glad to be informed of vacancies which Corporate Members of The Institution of Civil Engineers may have from time to time for Pupils or Apprentices, or for Assistants under Agreement. 6347

SITUATIONS WANTED (continued)

EDUCATED PRACTICAL ENGINEER, Widely experienced in manufacturing, OPEN to REPRESENT good HOUSE in Yorkshire district. Highest references.—Address, P4160, The Engineer Office. P4160 B

ENGINEER, A.M.I.C.E., DESIRES EMPLOYMENT. 15 years' first-class experience, including metallurgy, furnace and gas producer design and construction, gas and coke making, steel structural work, building construction, also commercial work and export. Knowledge of French.—Address, P4142, The Engineer Office. P4142 B

ENGINEER, A.M.I.M.E., &c., OPEN for Suitable APPOINTMENT. Many years' experience in factory planning, machinery lay-out, erection of buildings and plant for various purposes, including seed crushing, compound meals, edible oil refining, chemical processes, steam and electric installations, conveying machinery; also experience in modern methods of factory administration, economical working, &c.—Address, P4148, The Engineer Office. P4148 B

ENGINEER, A.M.I.C.E., Shortly Commencing practice as consulting engineer in South Wales, PREPARED to ACT as TECHNICAL REPRESENTATIVE for a Firm of repute. Sound experience in modern iron and steel practice, also tin-plate and sheet mills and collieries. London, North of England, and South Wales experience. Good connection with principals.—Address, P4127, The Engineer Office. P4127 B

ENGINEER, 23 Years' Experience in Marine, D.O., shop management, toolmaking, DESIRES A POSITION as AGENT for first-class firm. Live connection extending over nine years, Glasgow. Good organiser and salesman.—Address, 6323, The Engineer Office. 6323 B

ENGINEER (35), 7 Years Chief D.O., 2½ Years Charge of works, REQUIRES BERTH; experienced switches, crossings, lay-outs, rims, tires, axles, foundry, plant maintenance, &c.—Address, P4126, The Engineer Office. P4126 B

ENGINEER, Mechanical (35), B.Sc., A.M.I.C.E., 17 years' experience at home and abroad, marine shop trained, drawing-office, supervision new construction, sales and general commercial experience, SEEKS RESPONSIBLE POSITION as COMMERCIAL ENGINEER. Disciplinarian, hard worker, used to control. Technical correspondent in French and German and fair knowledge Spanish. Public school education.
Address, P4124, The Engineer Office. P4124 B

FULLY Qualified ENGINEER, with Considerable experience in steam, electric and conveying installations, the lay-out and working of plants for seed crushing, compound meals, edible oil refineries, chemical processes, and general machinery is OPEN to ACT as CONSULTANT, giving advice and full reports, preparing specifications, and negotiating the purchase of plant either for home or abroad.—Address, P4149, The Engineer Office. P4149 B

GRADUATE, Ex-Officer, 24, Recently Qualified (B.Sc. Eng. (Lond.); also A.C.G.I. (Electrical), DESIRES WORK on Electrical Machines, home or abroad. Inclination towards research; knowledge of French.—Address, P4150, The Engineer Office. P4150 B

MANUFACTURERS, if DESIROUS of NEGOTIATING with an ENGINEER travelling Lancashire, Yorkshire, &c., to undertake some special work, address in first instance, P4128, The Engineer Office. P4128 B

MECHANICAL ENGINEER, Age 23. Five Years' first-class works and technical training, good draughtsman, A.M.I.C.E. standard. Willing to go abroad, preferably France. Fluent French.—Address, P4167, The Engineer Office. P4167 B

MECHANICAL ENGINEER, A.M.I. Ae. E., Age 31. 16 years works, D.O., administrative, DESIRES POSITION as Assist. Works Manager, Dept. Manager, or similar post, at home or abroad. Varied experience, general, I.C.E., and small parts production. Patentee. Progressive position more important than high salary. —Address, P4138, The Engineer Office. P4138 B

MECHANICAL ENGINEER DESIRES Permanent SITUATION. Wide and varied experience, marine and I.C. engines, special purpose machines, &c. Thoroughly practical and theoretical training. At present works manager. Home or abroad. Excellent references.—Address, P4158, The Engineer Office. P4158 B

MECHANICAL ENGINEER, 18 Years' Good General experience as manager and foreman, also costing and travelling, SEEKS responsible POST, any capacity.—Address, P4118, The Engineer Office. P4118 B

QUALIFIED MECHANICAL ENGINEER, B.Sc., A.M.I.M.E., tactful organiser, 16 years' technical, commercial, administrative and practical experience; specialist in accurate repetition work, DESIRES CHANGE where scope and opportunities are afforded. —Address, P4136, The Engineer Office. P4136 B

PATENT AGENTS' TECHNICAL ASSISTANT, capable of working independently, knowing foreign languages, DESIRES SPARE-TIME EMPLOYMENT. —Write, Box 814, Sell's Advertising Offices, Fleet-street, E.C. 4. 6339 B

YOUNG ENGINEER, Stud. I.C.E., 5½ Years' apprenticeship with Messrs. Vickers, general workshop and office training, technical education, DESIRES POSITION as Assistant to Civil Engineer, to gain experience in civil engineering.—Address, P4156, The Engineer Office. P4156 B

YOUNG MAN (20), Medallist Technical College, DESIRES POSITION with Contracting Firm, knowledge of structural steel and reinforced concrete design.—Address, P4159, The Engineer Office. P4159 B

YOUTH, Age 18, REQUIRES SITUATION as JUNIOR DRAUGHTSMAN.—M., 1, Blomfield-street, Bury St. Edmunds. P4164 B

DRAUGHTSMAN (22½) SEEKS SIT.; 5 Years D.O., 3½ years foundry and workshops, 4 years technical college (evening); varied experience, ambitious, excellent references; salary moderate.—Address, P4166, The Engineer Office. P4166 B

ENGINEERING DRAUGHTSMAN (32), with 17 years' shops and D.O. experience, REQUIRES permanent POSITION. Well up in general and contractors' machinery, refrigeration, waterworks plant, and mechanical filtration.—P4110, The Engineer Office. P4110 B

SITUATIONS WANTED (continued)

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CASTINGS
Loam, Dry, or Green Sand.
Also Machine-made Repetition Work.
Good Delivery.
EASTON & JOHNSON, Ld., Taunton.

For continuation of Small Advertisements see page iii

SEPTEMBER.

The Oppau Disaster.

On the 21st a catastrophe of a terrifying nature overtook the works of the Badische Anilin und Soda Fabrik at Oppau, near Ludwigshafen, on the left bank of the Rhine. The Oppau works were founded in 1913 for the production of synthetic ammonia from the atmosphere by the Haber process. During the war the works, in addition to increasing greatly their output of ammonia, undertook the manufacture of high explosives and poison gases, and were, in consequence, made a frequent target for Allied bombing raids. Following the Armistice the factory reverted to its peace-time production of ammonia for agricultural purposes, and was responsible, it is said, for an annual output of 100,000 tons. An output of 200,000 tons per annum by the same process is derived from the Badische Company's works at Merseburg. These two works were therefore able to render German agriculture largely independent of imported nitre. The disaster of the 21st occurred about 7.30 a.m., just as the shifts of workpeople were about to change, and for this reason the casualty list was probably double what it might otherwise have been. The dead and missing numbered over 500, while several thousands were injured. The town was almost completely destroyed, and even at Münich, 175 miles distant, the shock of the explosion was noticeably felt. Various explanations as to the cause of the explosion have been advanced, some of them being of a ridiculous nature. It may be safely asserted that no experiment on a laboratory scale could, as has been asserted, have caused a disaster of this magnitude, while the statement that it was produced by the explosion of some newly discovered gas or substance concerning the properties of which little was known, can be dismissed on the ground that such a gas or substance would not be manufactured in sufficient quantity to cause such a far-reaching catastrophe until all its properties were very well understood. The Haber process is known to be attended by serious risks of explosion, and in the past has been responsible for several mishaps and accidents, both abroad and in this country, when during the war it was being studied on an experimental scale by the Ministry of Munitions. It may be added that ammonium sulphate—the agricultural product of the Oppau factory, according to report—is not explosive. Even ammonium nitrate is non-explosive until mixed with T.N.T.—or other substance—as in the manufacture of "Amatol."

Agricultural Tractor Trials.

Under the auspices of the Society of Motor Manufacturers and Traders some exceedingly instructive agricultural tractor trials were carried out during the month at Shrawardine, near Shrewsbury. A most praiseworthy feature of the event was that, though some forty machines had been entered, there was not one single case of mechanical failure, though the tests which had to be undergone were prolonged during a week and were of a sufficiently strenuous character. Not only had ploughs and cultivators to be hauled and threshing machines, straw cutters, presses, saws and pumps driven under ordinary working conditions, but the engines were all submitted to a belt power test by means of a Heenan and Froude dynamometer, while the complete machines were put through a draw-bar test with a Watson dynamometer so as to ascertain their overall mechanical efficiency. A point which was made very clear during the last-named test was that, in the majority of cases, only quite a small amount of the total power available was turned into useful work, because of the lack of adhesion or gripping power in the travelling wheels. Frequently the draw-bar horse-power did not represent much more than one-third of the power which the engine of the machine was capable of developing, and only one of the tractors on wheels showed an adhesion sufficient to give a return on useful work of more than 50 per cent. of the power of its engine. In that case deep inverted V-shaped spuds were bolted to the wheel rims. It is noteworthy that out of the total there were only three machines with chain tracks, though they showed a much better overall hauling efficiency than did the wheel machines. The forty machines taking part in the trials had been entered by a total of twenty-two makers, eight of them British, ten of them American, and one each from France, Italy, Sweden, and Switzerland. As showing the wide differences between the powers of the engines fitted to the various machines, we may say that the smallest engine is given as having been of 4.3 horse-power and the largest 45 horse-power, both on the S.M.M.T. rating. Curiously enough, for differing reasons, which had nothing to do with mechanical details, the maximum brake horse-power of neither of these machines was taken. In actual trials an American machine—a Hart-Parr—developed the highest maximum brake horse-power—30—though the British Wallis was only half a horse-power behind, while the lowest—6.25 horse-power—was developed by a small Swiss machine.

The Selby Railway Accident Report.

The report of Colonel Pringle on the collision of August 8th at Selby, North-Eastern Railway, was issued on the 16th of the month. Although the personal and material injuries were small—the most serious material damage was that a signal-box was pushed bodily 18in. out of position and all the points and signals were disconnected for some time afterwards—the accident provided many features that were instructive. The collision was caused by the driver of a North-Eastern train, standing on the up platform, accepting, as his, a signal which was "off" for a Great Northern express on the up through line. Hence the position occupied by the signals themselves was the main factor of the accident. The arm for the up platform line and that for the up through line were both on one post, fixed to the left of the up platform line. Colonel Pringle, therefore, says in his report: "If there is not space to provide separate posts on the proper left of each up line the up main line should be carried either on a bridge or cantilever arm well over the centre of that road." After two previous accidents of this character—at Preston Junction in August, 1896, and at Reading in June, 1914—trap points were inserted in the platform road so as to derail any train which started against the signal, and Colonel Pringle said that that was one of the only two positive methods of preventing an accident of this description; but it was doubtful whether, in this case, space was available in view of the position of the rails and connections of the adjoining up bay line. The other "positive method" was the automatic application of the continuous brake at the home signal when an engine passed that signal at "danger." He added that in a case of this sort control at the distant signal would not, of course, be of service. As this engine started from "dead" the distant signal did not enter into consideration.

A Motor Tanker.

The trial trip of the Conde de Churruca, which took place from the Walker yard of Sir W. G. Armstrong, Whitworth and Co., Limited, on the 8th of the month, was of more than ordinary interest, because the vessel is fitted with the largest Sulzer-Diesel two-cycle engines yet built, and because it is the intention of the owners to carry out prolonged trials on the use of ordinary boiler oil in place of the much more expensive Diesel oil. It was stated at the recent conference at the Institution of Mechanical Engineers that boiler oil was just as good for Diesel engines as the oil specially sold for them at a high price, and it will be interesting, on the one hand, to see whether it has any defects when used for months at a time, and, on the other, to witness the effect of its adoption upon the relative prices of the two classes of fuel. There is another matter in connection with the Conde de Churruca—which, we may remind our readers, was fully described and illustrated in The Engineer of September 16th—of interest to engineers. Following the practice which steam engines had made familiar, the designers of oil marine engines arranged for the control to be carried out on the engine-room floor. There are a good many reasons why that is the best place on general principles, but there are a good many other reasons why it is not the best place from the point of view of the oil engine. In the Conde de Churruca the engines are driven from an upper platform with all the valve motions directly under the eye of the engineer in charge, and it will be interesting to learn if this arrangement proves as convenient as the old one. We may take it that an old "First" would feel so out of place on a platform that he would condemn it out of hand; but a new type of engineer is being bred up for Diesel ships, and, being unbiassed by traditional instincts, may approve it.

The Iron and Steel Institute.

There can be no manner of doubt that the French were really glad to see the members of the Iron and Steel Institute when they paid a visit to France early in the month. Rumours were current that England was not in the best of odours on the other side of the Channel, and, as a matter of fact, the French hosts made no attempt to conceal their disappointment with the action of British politicians; but nothing checked the warmness of their welcome or the cordiality with which they entertained the Institute. We may, indeed, suspect that they were glad of the opportunity that the visit of nearly three hundred British engineers and ironmasters presented of explaining, at first hand, the condition of French industries and of exhibiting the effects of the war in the invaded areas. They hoped, no doubt, and justly, that if British people saw for themselves these things and heard, from their own lips, the appeals of the French, they might be the better able to influence policies and direct the actions of politicians. One or two of the papers had this object in view, and practically all the speeches dwelt upon the fear of France that Germany would sooner or later make war again if the most rigid restraint upon her were not exercised, and upon the need that French industries have for assistance. The visitors on their side showed no lack of sympathy with France, but the comment was freely made that the economic conditions in this country are still so bad that we are not in a position to help anyone, and that until our own trade revives we can hardly think of the trade of our great Ally. One may hope that when the present depression is succeeded, as it certainly will be, by a wave of prosperity, France may enjoy a period of profitable trade and see the many magnificent factories she is building fully employed.

Cleveland Technical Institute.

Towards the end of the month what is to be known as the Cleveland Technical Institute, which is situated in Corporation-road, Middlesbrough, was formally opened by Sir C. A. Parsons, F.R.S. The Institute, which is housed in a building which was once a New Methodist Connexion Church, owes its inception chiefly to the energy of Dr. J. E. Stead, F.R.S., who was ably assisted in his endeavours by Mr. J. Harrison, M. Inst. C.E. Its objects, which are far-reaching, are, amongst others, to encourage and facilitate the continued technical education of staffs and employees of the various works in the district; to encourage the advancement of the metallurgical, mining, engineering, and shipbuilding sciences to provide lecture rooms, a technical library and other facilities; to arrange lectures on subjects relating to local industries for the workmen and employees engaged in the district; to encourage and to investigate and make known the nature and merits of existing inventions, improvements, processes and designs which may seem to be of use to the industries of the district; to make grants of money, books, &c., and to give awards to students; and to use its funds in the employment of persons of learning or skill, and to use its instruments, appliances, and equipment for any form of scientific study which may be considered to have any bearing on the industries of the district generally. The building, which occupies a central position in the town, occupies a site which is 1200 square yards in area. It contains a library, a lounge, reading rooms, lecture hall, and a preparation laboratory, which is intended to facilitate the fitting up of any apparatus which may be required for demonstration during lectures. In his speech declaring the Institute open Sir Charles drew attention to one feature in connection with it which, he said, was worthy of special mention. It was that it was the wish of its founders that it should become a home common to members of all technical institutions or branches of technical institutions established in Middlesbrough. He described that object as being universally desirable, but added, as far as he was aware, it had only been attained in this country in Middlesbrough.

A New Telephone Exchange.

The London "Toll" telephone exchange, which was opened by the Postmaster-General on Saturday, September 24th, in the presence of a number of officials and visitors, should prove a boon to telephone subscribers. For some years past the volume of traffic over the trunk telephone system to and from London has been steadily increasing, and even before the war it was recognised that sooner or later a relief exchange would have to be provided. For financial and other reasons the work of constructing this new exchange had to be suspended until after the Armistice, when the pressing demands of the trunk traffic rendered it essential to put the scheme into practice. The new exchange, which is situated in Norwich-street, Fetter-lane, serves for

separating the long distance from the shorter distance trunk calls. Under the new system a subscriber who desires to call any provincial town within a distance of approximately 25 miles from London, measured radially from the centre of London, asks for "Toll" instead of "Trunk," and he is then connected to the new exchange. A great advantage of the new system appears to be that in the majority of cases the call can be completed without delay, as the trunk lines from London to the provincial towns served by the Toll exchange are arranged in such a way that they are all within easy reach of every telephonist.

The Shipping and Engineering Exhibition.

The exhibition which was held at Olympia from September 7th to 28th was fully as successful as its predecessor of the autumn of 1919, and was, if the opinion of some of the exhibitors was indicative of the whole, equally satisfactory as regard the business which it produced. At the previous exhibition a considerable amount of space was monopolised by foreign shipping and engineering interests, but last month there was not nearly such a large proportion of exhibitors from abroad; it was, in fact, the deliberate policy of the organisers to give precedence to British firms. The exhibits were of a very catholic nature and included practically all branches of engineering. It was noteworthy, however, that shipping did not play such a prominent part as the title of the exhibition would suggest, while, on the other hand, there was an unusually large amount of electrical apparatus and machinery on the stands. In connection with the exhibition a number of lectures on allied subjects was arranged and several of the technical institutions paid official visits. A cinematograph theatre was rigged up in one of the halls, and in it were shown films representing industries in various parts of the country. On Tuesday, September 27th, the day before the exhibition was closed, a dinner was held to commemorate the successful co-operation of the employers and workers as exemplified at the exhibition, and another indication of the same happy state of affairs was given by the good progress made in getting the stands ready before the public was admitted. At the dinner just mentioned, which was presided over by Captain Riall Sankey, president of the Institution of Mechanical Engineers, several well-known engineers and labour leaders expressed their opinions on the present relations between employers and workers.

The Indian Railways.

On the 16th was issued a summary of the report, and on the 23rd the report itself, of the Committee appointed a year ago to inquire into the future of Indian railways in view of the termination in 1924 of the contract with the East Indian Railway and in 1925 of that with the Great Indian Peninsula Railway and those with other railways in subsequent years. The Committee consisted of ten members with Sir William Acworth as chairman; three represented life-long experience of Indian railways, three represented Indian public opinion, one was a representative of the European commercial community in India, one was Mr. E. H. Hiley, late of the New Zealand Government Railway, and one was Mr. James Tuke, a London banker. The report says that the evidence was overwhelmingly strong as to the urgent need of drastic measures of reform and reconstruction of the entire railway machine. Congestion in India for years past had recurred each season; it has now become normal and will become permanent unless bold measures are taken to deal with the situation. These defects are due primarily to the failure of the Government to provide adequate funds both for capital works and for renewals, and are the inevitable results of a paralysing system which has not developed to meet the requirements of a great commercial enterprise. The appointment in the Governor-General's Council of a Member for Communications is recommended, and it is advised that the Railway Board should be replaced by a Railway Commission with a practical railwayman as Chief Commissioner and four Commissioners. The Finance Department should cease to control the internal finance of the railways, and the railway budget should be separated from the national budget. The system of management by guaranteed companies of English domicile should not be continued after the termination of the present contracts. The Committee was unanimous on the foregoing and all its other recommendations, but was evenly divided on the question whether the railways should be worked by companies domiciled in India or be managed by the State direct.

Developments in Power Station Design.

No. XII.*

The question of utilising waste heat for the purpose of generating electricity was undoubtedly one of the most important matters referred to in the report issued in 1917 by the Coal Conservation Sub-committee. Recommendation number six stated that power available from surplus gas or waste heat should be turned into electricity on the spot in local plants, which would feed into the main distribution system. Extensive use has been made of the waste heat from coke ovens and blast-furnaces on the North-East coast. Local generating stations erected where the surplus power is available feed into the Electric Power Company's system. The stations are run so that each supplies the maximum amount of energy possible with the supply of waste heat available, and all regulating is done at the main power station. Another source of waste heat is, of course, the exhaust steam from blowing engines, &c., but we shall deal in the present instance more particularly with plant for dealing with waste gas.

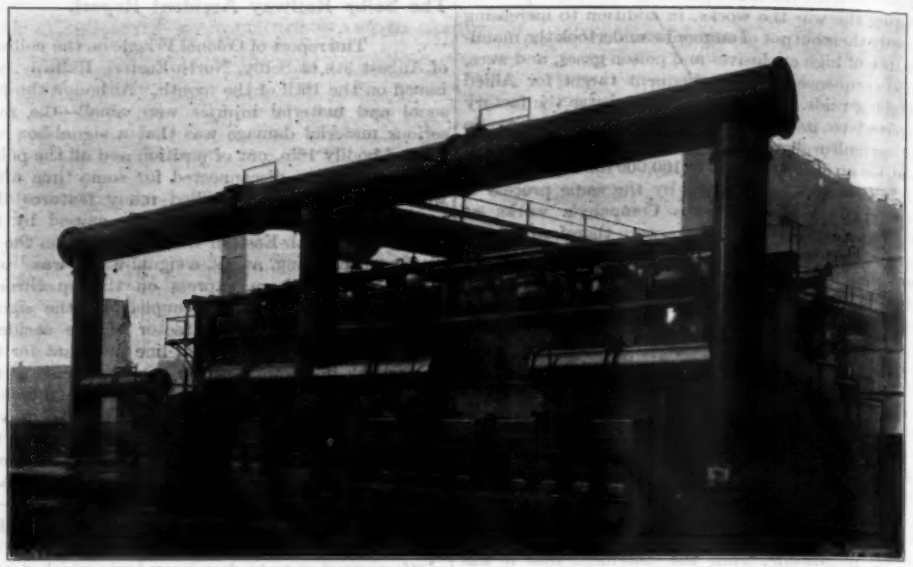


FIG. 59—FOUR BABCOCK AND WILCOX BOILERS FIRED WITH BLAST FURNACE GAS

A good many Babcock boilers are in use for recuperating the waste heat from re-heating, puddling and blast-furnaces, regenerative furnaces and coke ovens. In the case of re-heating and puddling furnaces the boilers are sometimes placed immediately above the furnace, whilst in other instances they are erected at the rear or side, the obvious advantage of placing them above the furnace being that they do not occupy any additional ground space. During recent years many of these boilers have been built for operation in conjunction with regenerative steel furnaces the gases from which leave at a temperature of between 1100 deg. and 1200 deg. Fah. In the case of puddling and re-heating furnaces the gases leave at a comparatively high temperature, and blowers are used in conjunction with the furnaces. The draught required at the furnace mouth is only very slightly affected by the interposition of the boiler, but in the case of a regenerative furnace, which requires a high draught at the mouth, it is necessary to take special precautions to ensure that the draught is not impaired. An induced draught fan is installed either at the rear of the boiler or between the economiser and the chimney, but an economiser is naturally only used when it can be shown that it will warrant the expense involved. The fan must give, in such cases, sufficient suction draught to make up for the loss arising from the passage of the gases through the boiler and economiser, and must produce the draught needed at the outlet of the furnace.

In the case of low temperature gases it is necessary to pass them through the boiler at a high velocity in order to obtain a higher transference of heat. Many Babcock boilers which are fired with blast-furnace gas are now in operation, and when the combustion of the gas is made perfect in a proper furnace the boilers will, it is said, work at more than their usual rated capacity. Blast-furnace gas is generally heavily laden with dust, and it is necessary to blow the dust from the tubes at frequent intervals. When clean gas is used a Bunsen burner gives a higher efficiency than it does when it is used with uncleaned gas. Babcock boilers are frequently employed for the

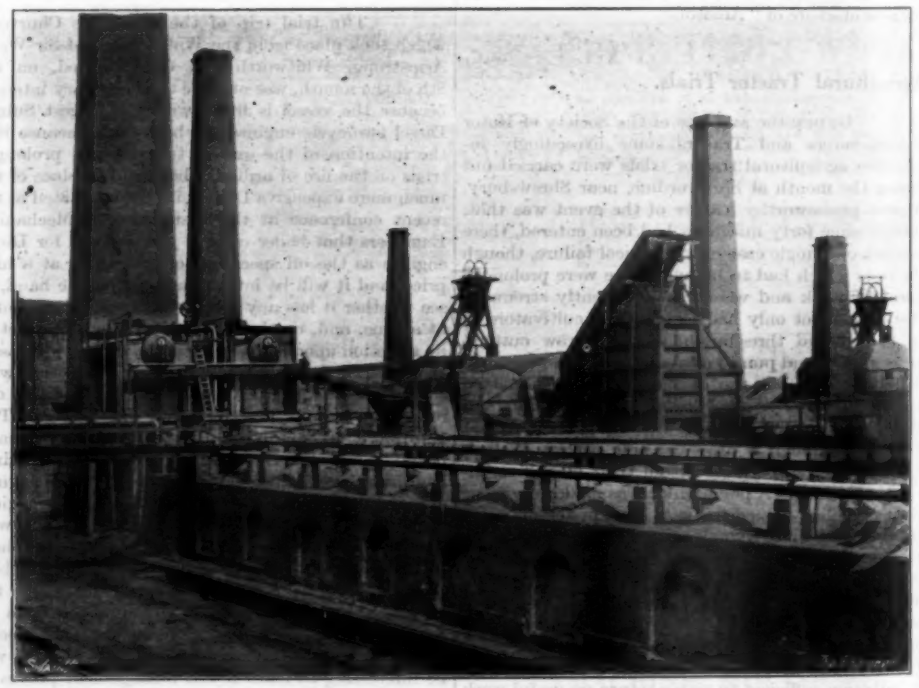


FIG. 60—TWO BABCOCK AND WILCOX BOILERS FIRED WITH WASTE HEAT FROM COKE OVENS

* No. XI. appeared September 30th.

utilisation of waste heat from coke ovens. They are fired with a combination of waste heat and live gas. When the former is in the form of gas which is already combusted, no furnace is required, but if the surplus live gas is used at the same time it can be burnt to best advantage in a Bunsen burner built into the front wall of the boiler and immediately under the tubes. In Fig. 59, four Babcock boilers, each having a heating surface of 4510 square feet and fitted with superheaters, are shown together with the mains, &c., for firing with blast-furnace gas, whilst Fig. 60 shows two of the same type of boilers each having a heating surface of 2255 square feet and worked with the waste heat from coke ovens. Since this plant was installed, seven additional boilers have been put into service.

The general arrangement of a waste heat plant of exceptional interest is shown in the drawings, Figs. 61 and 62. The plant has been built by the Société Alsacienne de Constructions Mécaniques, for which Dieny and Lucas, of 329, High Holborn, are the London agents, and it is being erected in one of the leading steel works in France. The waste heat available, to utilise which the plant has been designed, is derived in connection with the manufacture of 1200 tons of pig iron per twenty-four hours. The output is obtained from four blast-furnaces which produce approximately 14,200,000 cubic feet of gas per hour. From the blast-furnaces the gas passes through eight dust separators—shown in Fig. 61—and the pipes A convey the gas to the cooling plant B. After the gas has been cooled down sufficiently it passes on to the cleaning installation C, which consists of ten electrically driven purifiers capable of purifying 7,800,000 cubic feet of gas per hour to .0437 grains of dust per cubic foot or to 0.1 gramme per cubic metre. This gas is used for firing boilers. The plant is also capable of cleaning 3,530,000 cubic feet per hour to .0087 grains of dust per cubic foot, or to 0.02 grammes per cubic metre, and this gas is used for driving engines. To the outlet of each cleaner a water separator is fitted, and water is therefore separated from the gas. When the water in the separators has served for cooling and purifying the gas, it is collected in settling tanks placed underneath the cleaning apparatus, and the water can then be used over again or it can be discharged into a river. The gas which is used for raising steam passes through the various Cowper apparatus to the boilers, where it is fed into the burners at constant pressure, which is controlled by patented automatic governors. Safety devices are provided to protect the installation in the event of a shortage of gas or a failure in the electric current.

The plant shown in the drawing—Fig. 62—consists of the blowing engine installation, the electric generating station and the boiler-house. The blowing engine installation consists of five engines E 1 arranged in tandem, each set being capable of delivering 42,500 cubic feet of free air per minute at a maximum pressure of 14.2 lb. per square inch, two steam-driven blowing engines E 2, and two turbo-blowers E 3. These latter blowers serve for starting up the works, and act as a stand-by in the event of a shortage of gas. They also serve for the utilisation of any excess steam developed by the waste heat boilers heated from the exhaust from the gas engines. There are, in addition, two air compressors E 4, which deliver air at a maximum pressure of 285 lb. per square inch, and these are used for starting up the gas engines and for operating various pneumatic appliances installed in the power-house.

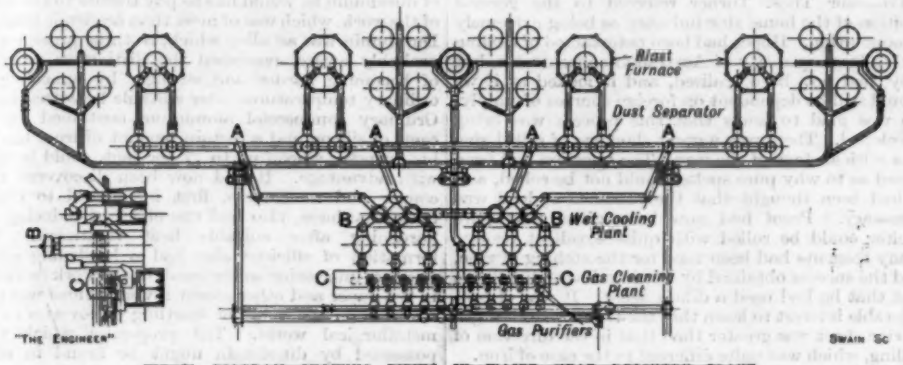


FIG. 61—DIAGRAM SHOWING PIPING IN WASTE HEAT RECOVERY PLANT

The electric generating plant consists of seven alternators driven by blast-furnace gas double tandem engines F 1, each set having a capacity of 2900 kilowatts, three turbo-alternators F 2, rated at 4800 to 6000 kilowatts, and two turbo-alternators F 3 rated at 2800 to 3500 kilowatts. In the boiler-house there are nineteen waste heat boilers G 1 with superheaters, and each boiler is heated by the exhaust gases of one of the engines. These boilers, which work at a pressure of 180 lb. per square inch, recover, according to the temperature of the exhaust gases, 1600 to 2400 B.Th.U. per brake horse-power developed by the gas engines, and the steam from the boilers is used to drive the two turbo-alternator sets F 3. There are also eight multi-tubular boilers G 2, each having 5170 square feet of heating surface and working at a pressure of 285 lb. per square inch. These gas-heated boilers, which are fitted with superheaters, economisers, re-heaters for the air and artificial draught apparatus, supply steam for driving the turbo-alternator sets F 2. The four multi-tubular boilers G 3 are arranged for mixed heating, and drive the steam engines E 2 and the steam turbines E 3, which serve for starting up and as a stand-by. The water distillation plant H deals with the boiler water and that supplied to the engines for cooling. A repair shop contains, in addition to the machine tools necessary for repairs, all the spare parts for the installation. The feed pump and water circulating water pumping installation is shown at J, and the oil stores at K. From these stores pipe lines run to each machine, and the waste oil and clean filtered oil are returned to this spot. The exciter sets are shown at L, and the control disc and switchboard at M.

The complete installation is capable of cleaning and converting into useful work 14,200,000 cubic feet of gas per hour, of producing 17,000,000 cubic feet of blast per hour, and of generating 45,000 kilowatts.

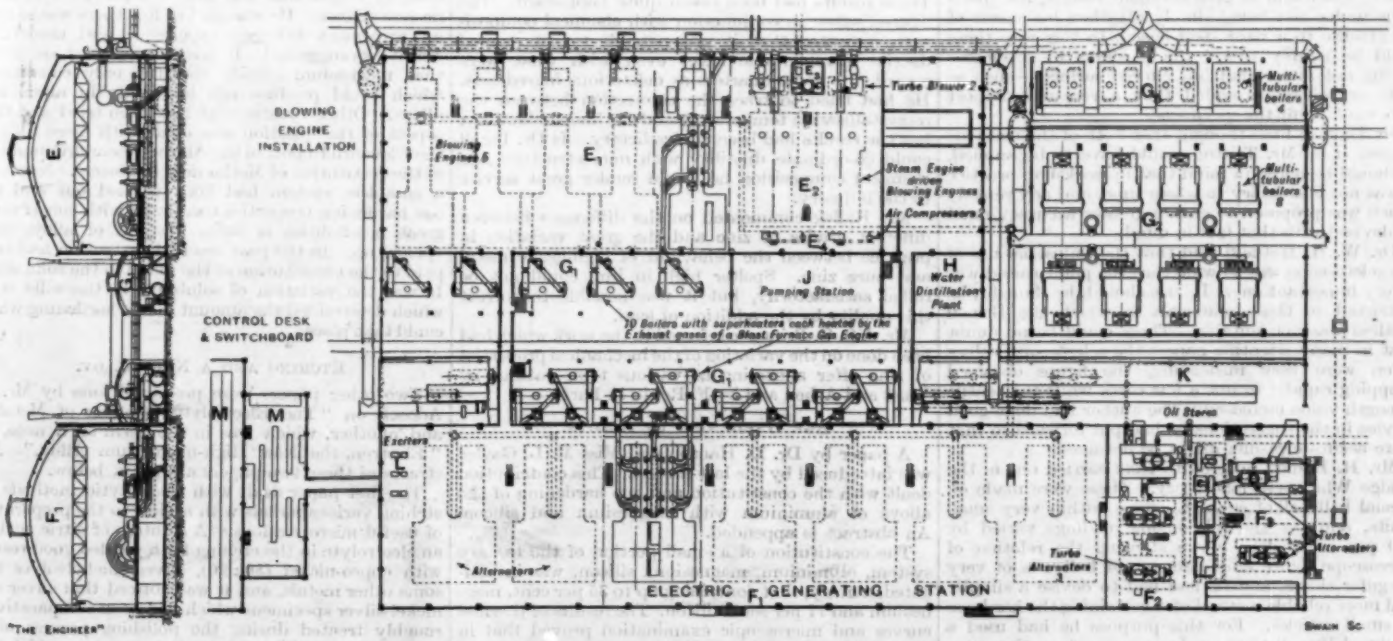


FIG. 62—GENERAL ARRANGEMENT OF POWER-HOUSE OPERATED BY WASTE HEAT

Institute of Metals.

AUTUMN CONFERENCE IN BIRMINGHAM.

No. III.*

Extrusion Defects.

The chair was occupied by the President, Engineer Vice-Admiral Sir George Goodwin, when the conference was resumed on September 22nd. The first paper taken was that by Mr. R. Genders on "The Extrusion Defect." An abstract of this contribution is appended.

The experiments described in this paper were carried out with the object of devising a method of extrusion which would avoid the formation of the defect (known by the misleading term "piping") which is commonly found in a certain proportion of centrally extruded rod made from brass and other non-ferrous alloys by the usual hot-extrusion process. The defect is tubular in the interior of the rod and generally exists in the last portion (up to 25 or 30 per cent.) extruded. When a defective rod is broken across, the core frequently breaks at a different point from the outer ring and projects and is sometimes quite loose. It has been shown that the defect consists of foreign matter, oxide and de-zincified brass, which constitutes the skin of the original billet. Billets extruded to various stages and sectioned axially show the presence of the defect in the shape of a funnel, formed by the turning inwards of the billet skin which cannot flow along the side of the receiver owing to friction and its lower temperature. The defect can be largely overcome by the use of a ram smaller in diameter than the billet, which causes the outer layer of the billet to remain in the receiver as a thin cylinder, but the method would probably be too wasteful on a large scale. By inverting the process so that the die is pushed through the billet, the mode of flow is altered. There is no relative movement between the billet and receiver and the flow is confined to the region of the die. Experiments on a small scale, using 60 : 40 brass billets and extruding under conditions comparable with large-scale work have shown this method to be successful in avoiding the "extrusion defect," the skin of the billet being turned over and collected on the face of the die, none entering the aperture of the die until the extrusion is nearly complete, when it emerges on the outside of the rod. The power required is less than with the method at present in use. Rod produced by the method is completely sound. The method is in use in many places for the production of tubes and rod from soft metals, although the plant appears to have been so designed only with a view to mechanical efficiency without any appreciation of possible effect on the quality of the product and has not so far, to

* No. II. appeared September 30th.

the author's knowledge, been used for hot extrusion of copper alloys. The necessary modifications of the plant would probably be fully justified by the saving of the very large amount of metal which by the present method is extruded, only to be ultimately scrapped.

Mr. H. Moore wished to make it clear that the defects dealt with in the paper were not due to any defect in the original ingot. The defect occurred in every case, and always in the last 30 per cent. of the rod extruded. When the research was started at Woolwich the impression—it was, perhaps, a natural one—prevailed that what happened was caused by some defect in the ingot, but that explanation had been put entirely out of court. It was to be regretted that practical manufacturers had not come forward and given their experience, as the main object of the paper was to elicit opinions on a subject of general practical interest. Manufacturers were difficult people to extract information from, but the defect was still occurring, and something ought to be done to throw further light upon the problem.

Mr. Genders also expressed regret that manufacturers had not come forward with some helpful suggestions. It was disheartening to research workers, who did their best to give information, if they got no corroboration or criticism from makers. During the war period it seemed as if an end had been put to the old policy of secrecy, but it was now present again in full force.

Sir George Goodwin added his protest on the subject of the reticence of manufacturers. He thought the work which had been done imposed an obligation on them as well as on users to give information. It was a duty they owed to the Institute, and he was extremely disappointed that they appeared to be content to be listeners.

Use of the Scleroscope.

A paper dealing with the use of the scleroscope on light specimens of metals was presented by Mr. F. S. Tritton, of the National Physical Laboratory.

Some experience in the use of the scleroscope for testing the hardness of small pieces of metal in the laboratory led the author to doubt whether the real hardness values of small samples were obtained, although the usual precautions were taken to support the specimens in an apparently rigid manner. Experiments were therefore undertaken with a view to finding out whether errors existed when using the ordinary methods of support, and, if so, to find some method of support that would eliminate them. Errors were detected, and to reduce them the author selected two materials, respectively pitch and glucose, for the purpose of supporting the specimens in the scleroscope. The use of pitch required a special clamp. On the other hand, without the use of a clamp, a solution of glucose considerably stiffer than treacle was found to give excellent results, the specimens under test being simply attached by means of the glucose to a hard steel base. In this way there could be readily tested the hardness of specimens having not merely flat but curved surfaces—such as balls or rollers—provided that a recessed support were made to fit the specimens.

Sir Thomas Rose thought that both of the methods suggested by Mr. Tritton would have to be applied. It should be borne in mind that in workshop practice it was not customary to waste time, and any remedy which was proposed to ensure greater accuracy must be devised with that fact in mind.

Dr. W. H. Hatfield said that the industrial use of the scleroscope was so wide that the point raised was a very important one. Its use should, he thought, be restricted to those materials to which the Brinell method was not suitable. There could be no doubt that in many scientific papers the scleroscope values given were very misleading, the figure obtained dropping rapidly in not a few cases while the tensile strength value increased. The author had done good service in the suggestions he had put forward so that more accurate results might be obtained.

Mr. H. Hedley referred to tests carried out in the Rudge Whitworth laboratory. These were made on special balls, all of equal hardness within very small limits, and yet the scleroscope readings varied by 100 per cent. The curve showing the relation of scleroscope figure and diameter of ball was of very irregular shape, and he had had to devise a simpler and more reliable method of ascertaining the hardness of small articles. For this purpose he had used a modified Brinell test, employing an automatic centre punch in conjunction with a ball holder, and had found it an effective device. Mr. Moore, who had experienced the same difficulty, had used a method of pressing the article to be tested with a ball under a pressure of about 10 kilos.

Dr. Gwyer thought that whatever the defects of the scleroscope, it was an extremely useful implement from the workshop point of view. He had found that for the testing of thin sheet the scleroscope was much the handiest instrument. For ascertaining the relative rather than the actual values it was to be preferred. In his experience no two scleroscopes gave the same reading with the same material.

Annealing of Rolled Zinc.

A paper was brought up and briefly presented on "The Annealing of Rolled Zinc."

The polishing and etching of cast and rolled zinc were investigated in detail. The mechanical properties of pure rolled zinc with a reduction by rolling of 77 to 96 per cent. were determined for the following conditions:—(1) As rolled; (2) annealed for 30 min. at 100 deg. Cent.; (3) annealed for 30 min. at 150 deg. Cent.; (4) annealed for 30 min. at 200 deg. Cent. It was found that:—(*a*) Only average values for mechanical properties were obtainable, as the material was variable. (*b*) The material as rolled and also when annealed at 100 deg. and 150 deg. Cent. was ductile "with" and brittle "across" the direction of rolling, with reductions from 77 to about 87 per cent.; it was ductile in all directions with 96 per cent. reduction by rolling, under which amount the strength rose from about 6 to about 13 tons per square inch. These changes were obscured by the microstructure, which was an equi-axed structure in all cases. (*c*) Annealing for 30 min. at 200 deg. Cent. rendered the material completely brittle and weak, as a result of crystallisation.

Professor Thos. Turner referred to the general position of the home zinc industry as being extremely disappointing. Hopes had been entertained of dealing with a large quantity of Australian concentrates, but they had not been realised, and it looked as if we should still be dependent on foreign sources of supply. He was glad to know that this process was being developed. There was a great shortage of rolled zinc at a critical stage of the war. The question had been raised as to why pure spelter could not be rolled, and it had been thought that the presence of lead was necessary. Proof had now been given that pure spelter could be rolled with quite excellent results. Many reagents had been used for the etching of zinc, and the success obtained by Dr. Ingall was due to the fact that he had used a dilute agent. It was of considerable interest to learn that the transverse strength of zinc sheet was greater than that in the direction of rolling, which was quite different to the case of iron.

Mr. Thornwell quoted some results which were comparable with those given by the author. The figures were obtained in works practice at Stewarts and Lloyds and corresponded to Dr. Ingall's A series. These were as follows:—

Reduction average.		Yield point.	Limit of stress.	Elongation on 2in.	Reduction of areas.
		Tons.	Tons.		
62 per cent...	High	11.00	13.60	9.0	15.46
	Low	7.51	10.50	5.0	2.26
	Average	10.10	11.99	6.7	8.63
80 per cent...	High	12.81	14.53	18.5	22.50
	Low	8.96	13.15	1.0	5.64
	Average	11.32	13.75	8.7	9.52
86 per cent...	High	14.19	17.07	21.5	47.17
	Low	12.47	16.29	10.5	23.48
	Average	13.43	16.84	14.5	31.01

These results had been taken quite haphazard. The figures, taken in conjunction with chemical composition, indicated that it was possible to get a good ductile merchantable sheet even with what were regarded in some quarters as deleterious ingredients. He had tried to trace the connection between the recrystallisation temperature and the known ductility, but the results had been contradictory. If Dr. Ingall could co-ordinate ductility with microstructure and chemical composition he would render great service to the industry.

Mr. Ridley commented on the difference between different grades of zinc and the great variation in practice between the behaviour of high-grade metal and pure zinc. Spelter high in iron could not be rolled satisfactorily, but it was possible to correct this quality by the addition of lead.

Mr. J. S. G. Primrose referred to the work which had been done on the variation of the mechanical properties of zinc after annealing at various temperatures by Wust and Achen and by F. Robin in Paris.

Age Hardening of Alloys.

A paper by Dr. D. Hanson and Miss M. L. Gayler was introduced by the last-named. This contribution dealt with the constitution and age hardening of the alloys of aluminium with magnesium and silicon. An abstract is appended.

The constitution of a small portion of the ternary system, aluminium, magnesium, silicon, was investigated, namely, that containing up to 35 per cent. magnesium and 11 per cent. silicon. The results of thermal curves and microscopic examination proved that in these alloys, magnesium and silicon formed a chemical compound having the formula Mg_2Si. This compound and aluminium formed a eutectiferous binary system, having a eutectic containing 13 per cent. of Mg_2Si, and melting at 590 deg. Cent. Two ternary systems were formed with silicon and magnesium respectively. The aluminium—Mg_2Si—silicon system possessed a ternary eutectic that melted at 550 deg. Cent.; the ternary eutectic of the aluminium—Mg_2Si—magnesium system melted at 450 deg. Cent. The solubility of the compound Mg_2Si in solid aluminium was determined, and the results showed that Mg_2Si was more soluble at high than at low temperatures, 1.6 per cent. Mg_2Si being held in solution at 580 deg. Cent., and little more than 0.5 per cent. Mg_2Si at 30 deg. Cent. Excess of silicon had little effect on the solubility of Mg_2Si, but magnesium reduced the solubility at high temperatures. This difference in the solubility of Mg_2Si in solid aluminium at high and low temperatures was the cause of the age-hardening property of these alloys. The alloys of this system, after quenching from high temperatures, were found to be relatively soft, but gradually became harder; this age-hardening ceased after a few days. The age-hardening of a series of alloys containing increasing amounts of Mg_2Si rose progressively until the limit of the solubility of Mg_2Si in aluminium at the quenching temperature was reached, beyond which the total increase in hardness remained constant. The increase in hardness produced during the ageing of the alloys was thus roughly proportional to the amount of Mg_2Si retained in solution by quenching. Confirmation of this view was also obtained from experiments with alloys of aluminium and Mg_2Si with magnesium or silicon.

Professor C. H. Desch welcomed the paper as a model of how such a subject should be treated. The conclusions drawn seemed to be entirely unassailable.

Mr. H. B. Weeks said that as the reputed discoverer of duralumin he would like to pay tribute to the value of the work, which was of more than academic interest. Duralumin was an alloy which, as those present were probably aware, possessed the distinctive property of becoming harder and stronger by annealing at ordinary temperatures after suitable heat treatment. Ordinary commercial aluminium contained .4 per cent. of silicon and a certain amount of iron, but for his purposes silicon up to .7 per cent. could be used with advantage. It had now been discovered that copper and manganese, first introduced to obtain initial hardness, also had the effect of inducing age hardening after suitable heat treatment. The formation of silicides also had a hardening effect. His own impression as the result of the work described in the paper and other recent investigations was that we were on the verge of startling discoveries in the metallurgical world. The properties which were possessed by duralumin might be found in other alloys.

Mr. H. Moore thought the question of age hardening required further investigation, and referred to the possibilities of a light aluminium alloy containing 10 per cent. of zinc, 2 to 3 per cent. of copper, and a small amount of magnesium. Age hardening was a comparatively rapid process. He did not think that it occurred in binary alloys, but in the ternary alloys, such as aluminium-copper-magnesium and aluminium-zinc-magnesium very intense hardness could be produced after suitable heat treatment. He was not sure whether the authors intended to suggest that the hardening was due in every instance to the presence of silicide of magnesium. It seemed difficult to account for it on that assumption to the disregard of other possible causes.

Dr. Hanson, in reply, expressed his interest in what Mr. Weeks had said. A percentage of silicon of .7 would combine approximately with 1.1 per cent. of magnesium and give 1.8 per cent. of magnesium silicide. He was glad to find there was so close an agreement between experience and theory, as Mr. Wicks suggested. It was not, however, suggested that magnesium silicide was the only constituent which could produce age hardening in aluminium alloys. Other constituents had been tried and this, aspect of the question was dealt with more fully in the Eleventh Report of the Alloys Research Committee of the Institution of Mechanical Engineers. Now that a complete system had been worked out and the age hardening properties correlated with constitution great possibilities in other systems of alloys were opened up. In the past too little attention had been paid to the constitution of the metal in the solid state. It was the variation of solubility in the solid state which determined the amount of age hardening which could take place.

Etching and a New Alloy.

Two other papers were presented, one by Mr. F. Adcock on "The Electrolytic Etching of Metals," and another, which was in the form of a note, on "Electron, the New High-magnesium Alloy." Abstracts of these two papers are given below.

The first paper dealt with electrolytic methods of etching various metals with a view to the preparation of useful micro-sections. A solution of citric acid as an electrolyte in the etching bath yielded good results with cupro-nickel (80 : 20), silver, nickel-silver and some other metals, and it was noticed that silver and nickel-silver specimens which had been comparatively roughly treated during the polishing process often gave clearer etchings than the specimens which had been polished with great care. Another electrolyte made by dissolving molybdic acid in excess of ammonia solution gave somewhat similar results. By making use of such reagents as hydrofluoric acid, chromic acid, and bromine water, both the cores (or dendrites) and the crystal grain boundaries of cast cupro-nickel were disclosed simultaneously.

Samples of the new alloy "electron" examined by the author of the second paper contained about 95 per cent. of magnesium, 4.5 per cent. of zinc, and 0.5 per cent. of copper. They were in the form of rod, probably extruded at a raised temperature. One sample showed evidence of having been subjected to cold heading. The alloys machined well, and compared very favourably with aluminium alloys in tensile properties—allowance being made for the much lower specific gravity—but they were not so ductile in compression. On account of the danger of fire very strict regulations are necessary to prevent the

accumulation of turnings beyond a certain amount in the factories where these alloys are machined.

The afternoon was devoted to visits to works in the Birmingham district, and in the evening a garden party was held at the Botanical Gardens, Edgbaston.

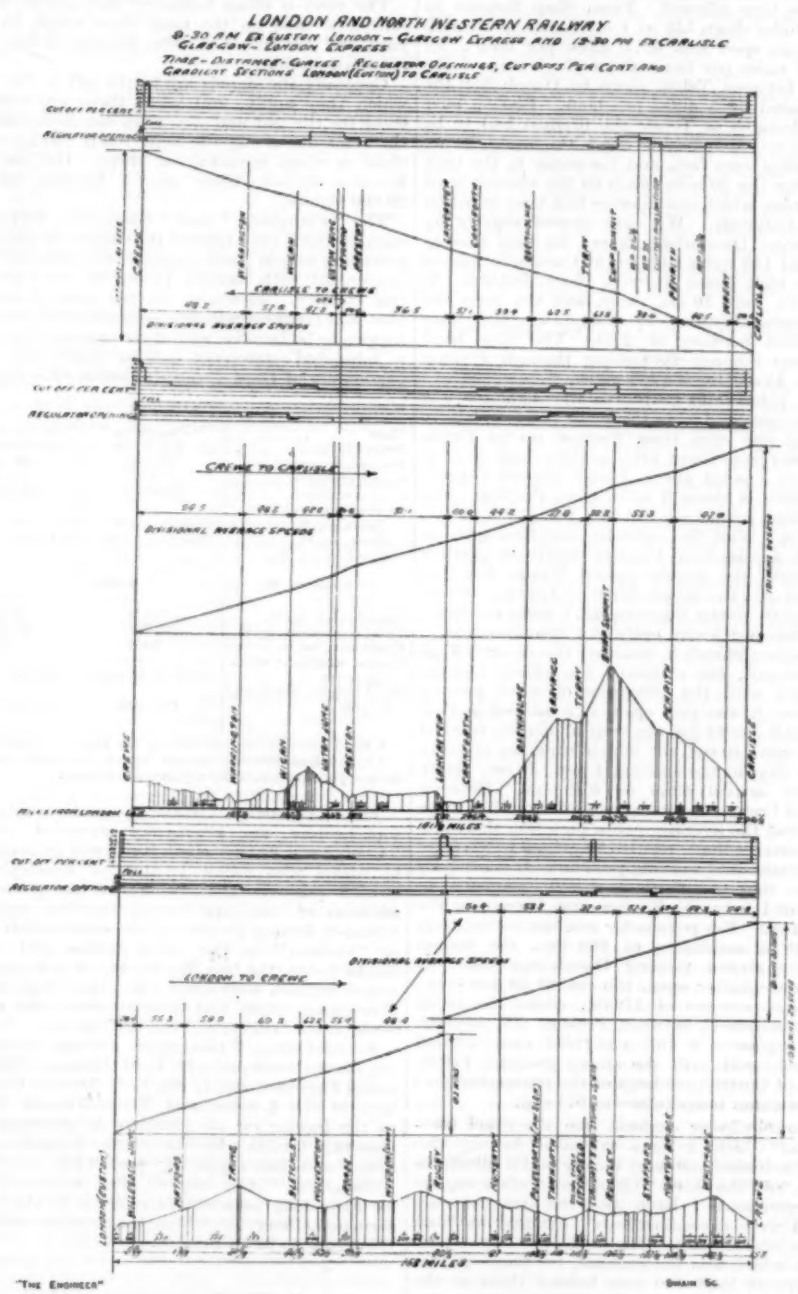
The concluding day of the meeting, Friday, September 23rd, was devoted to an excursion to Warwick, Leamington, and Stratford, during which members were received at Teddington House by Sir Gerard Muntz, past President of the Institnte.

Some Recent Locomotive Work on the L. and N.-W. Railway.

No II.*.

By E. C. POULTNEY, M.B.E., A.M.I. Mech. E., M. Am. Soc. M.E.

In my preceding article certain journeys between London and Crewe were described, and in the present contribution I shall deal with two interesting footplate runs on the London and North-Western Railway.


LONDON AND NORTH WESTERN RAILWAY
9.30 AM EX EUSTON LONDON – GLASGOW EXPRESS AND 12.30 PM EX CARLISLE GLASGOW – LONDON EXPRESS
TIME-DISTANCE CURVES REGULATOR OPENINGS, CUT OFFS PER CENT AND GRADIENT SECTIONS LONDON (EUSTON) TO CARLISLE
CUT OFF PER CENT
REGULATOR OPENINGS
CARLISLE
CARLISLE TO CREWE
DIVISIONAL AVERAGE SPEEDS
CREWE TO CARLISLE
LONDON TO CREWE
"THE ENGINEER"

TIME-DISTANCE CURVES AND GRADIENT PROFILES

For my first trip I selected the 9.30 a.m. ex Euston, this train being the London (Euston) and Glasgow (Central) luncheon car express. The train stops only twice on the journey to Carlisle, first at Rugby and again at Crewe, where engines are changed and where a through coach for Edinburgh is added.

My return journey was made from Carlisle to Crewe on the train due to leave at 12.30 p.m. and to arrive at Crewe at 3.29 p.m., the journey being performed without a stop. This is the 10 a.m. ex Glasgow, and is the corresponding "up" train to the one which I travelled with from London on the "down" journey.

Logs Nos. 3, 4, and 5, together with the diagrams on which are shown the regulator openings and cut-offs, and on which the time distance curves are plotted against the gradient sections between London and Carlisle, will give sufficient information to indicate the working of the locomotives, which throughout were of the latest "Claughton" class.

From Euston to Crewe on the 9.30 a.m. Anglo-Scottish express I travelled by engine No. 85, built at the Crewe works in April, 1920. The train was made up of W.C.J.S. vehicles and consisted of six eight-wheeled and two twelve-wheeled coaches, the latter being the luncheon cars. The train was vestibuled throughout and was fairly well filled with passengers. The weight behind the tender was 257 tons, thirty-six axles, no allowance being made for the passengers or baggage. The load was, of course, very light for an engine of this class, and after passing Willesden 1 min. late we were before time all the way to Rugby, which was reached 9 min. early, and in 93 min. from Euston, representing an average speed of 53.2 miles per hour. From Euston up to Tring the regulator was one-third open and the cut-off 30 per cent., and the speeds up the bank were very good, especially between Watford and Tring, where an average of 59.9 miles per hour was attained. At Bushey, 16 miles from London, the first water troughs are situated, and here the fireman let down the scoop and filled up the tank.

Down the bank from Tring to Bletchley, with the regulator one-quarter open and the cut-off reduced to 25 per cent., we made 69.2 miles per hour and 62.2 for the succeeding 5¾ miles on to Wolverton, the regulator opening and cut-off being unchanged. From Wolverton up to Roade the speed, it will be noticed, fell off to 55.4 miles per hour. It is rather interesting to note the change in speed due to the road contour with the regulator opening and cut-off constant.

The second set of water troughs is at Castlethrop, between Wolverton and Roade, about 55 miles from London, and 40 from the troughs at Bushey. There, again, the tank was replenished, and about 25 miles further on near Rugby are the third water troughs, on reaching which the tank was again filled.

Loc No. 3.—*London and North-Western Railway.*

9.30 a.m. ex London (Euston), London–Glasgow Express.

Engine No. 85, four cylinders, 4–6–0 type. Train weight and composition, six eight-wheeled cars, two twelve-wheeled, 257 tons.

Stations.	Miles.	Time. Booked	Time. Actual.	Speed, m.p.h.	Steam press.	Steam temp.
		h. min.	h. min. sec.			
Euston, dep.	—	9 30	9 30 0	—	175	—
					165	680
Willesden, pass	5½	9 40	9 41 0	28.4	170	
Watford ..	17¼	9 55	9 54 30	55.3	165	
Tring	31½	10 12	10 8 40	59.9	175	640
						660
Bletchley ..	46½	10 29	10 21 40	69.2	160	
Wolverton ..	52½	—	10 26 50	62.2	160	610
Roade	59½	10 44	10 34 50	55.4	—	610
Rugby arr	82¼	11 12	11 3 0	48.4	175	
Rugby dep.		11 18	11 17 50		165	680
Nuneaton ..	97	11 36	11 35 5	50.4	165	
Polesworth ..	108½	Steam off, slow 40 m.p.h.			175	640
Tamworth ..	110	11 51	11 48 30	58.2	175	650
Litchfield ..	115½	Signal check				
Elmshurst ..	118	Stopped by signals 1½ min.				
Signal Box ..	119					
Rugeley ..	124½	12 8	12 12 5	37.0	165	670
		Steam off round curve, 35 m.p.h.				
Stafford ..	133½	12 19	12 21 25	57.8	170	
Norton Bridge	138⅝	12 27	12 26 35	62.4	160	
Whitmore ..	147¼	12 36	12 36 30	52.3	145	
Crewe, arr. ..	158	12 50	12 48 0	54.8		

On passing Roade the engine was notched up to 22 per cent., about; this, with the Weeden slow, had the effect or reducing the speed to 48.4 miles per hour for the 22¾ miles between Roade and Rugby.

After a wait of 14 min. 50 sec. the train left Rugby for Crewe at 11 h. 17 min. 50 sec. The regulator was only one-quarter open and the engine was quickly notched up to about 22 per cent. cut-off.

Between Rugby and Stafford we were slowed at Polesworth to 40 miles per hour for permanent way reasons, and at Elmshurst signal-box between the 118th and 119th mile-posts, we were stopped for 1½ min., after having been checked by signals at Litchfield. These delays caused us to be 4 min. 5 sec. late passing Rugeley and 2 min. 25 sec. lat passinge Stafford; however, at Norton Bridge, 5⅛ miles from Stafford, the train was 25 sec. early, the passing time being 12 h. 26 min. 35 sec., against 12 h. 27 min. booked, and Crewe was reached exactly 2 min. before time, the train coming to a stand in the station at 12.48 against the scheduled time of 12.50 p.m.

Between Rugby and Crewe there are two sets of water troughs, the first being near Litchfield and the second set, the sixth from London, at Whitmore, 10¼ miles from Crewe.

The average results of the run between Euston and Crewe show that the mean boiler pressure was 167 lb. The maximum pressure was 175 lb., and the lowest pressure recorded was 145 lb. at Whitmore. The mean pressure is the average of sixteen readings, five of which indicated the maximum working pressure of 175 lb. Nine different readings of the pyrometer gave an average steam temperature of 649 deg. Fah.; the highest temperature recorded being 680 deg. going up to Willesden, and again after leaving Rugby. The mean speed between Euston and Rugby was 53.2 miles per hour, and between Rugby and Crewe 50.2 miles per hour. This figure includes the time lost at Elmshurst Box and the Polesworth permanent way slow. The overall or journey time speed from London to Crewe was 47.8 miles per hour, and the mean running time speed was 51.7 miles per hour. At Crewe engines were changed, and I had for the run to Carlisle another new Claughton, No. 2035, built in March, 1920. Referring to Log No. 4, which details the journey to Carlisle, it will be noticed that the time given for leaving is apparently in advance of the booked time by 25 sec. My watch was carefully checked with the station time at Euston, so the difference is due to Crewe and Euston Station times not agreeing.

The load at Crewe was increased by the addition of one eight-wheeled corridor composite coach of 30 tons tare weight, so that the load behind No. 2035 was 287 tons, forty axles. As on the journey from London to Crewe, the running showed an improvement on the booking all the way, and an inspection of the regulator openings and cut-offs employed will show that the engine was working considerably within her powers. The speed between passing Uxton Junction and passing through Preston was low, because we went through the latter station with extreme caution and ran the 6¼ preceding miles with the regulator shut. We eased also passing Lancaster, but ran the 6¼ miles to passing Carnforth in the even 6¼ min.; this was the highest sustained speed recorded on the run.

The work on this section begins after passing Carnforth; here the regulator was opened more and the cut-off adjusted to 25 per cent. It had been 20 per cent. between Preston and Carnforth. The way the engine was notched up again to 20 per cent. after passing the summit of the Grayrigg Bank at Grayrigg Station and run in that position almost up to Tebay indicates how very carefully the driver operated his engine.

* No. I. appeared September 30th.

The speed between Oxenholme and Tebay averaged 37.8 miles per hour, but we passed Tebay at fully 50 miles per hour. Shap Bank was ascended in 10¼ min. with the regulator two-thirds open and the cut-off 40 per cent., the pressure being close to 175 lb. throughout the whole time. The speeds down the

Log No. 4.—*London and North-Western Railway.*

1 *p.m. ex Crewe, London–Glasgow Express.*

Engine No. 2035, four-cylinders, 4–6–0 type. Weight and composition of train, seven eight-wheeled cars and two twelve-wheeled cars, 287 tons.

Stations.	Miles.	Time. Booked	Time. Actual.	Speed m.p.h.	Steam press.	Steam temp.
		h. min.	h. min. sec.			
From London	158					
Crewe, dep. ..	—	1 0	12 59 35	—	175	—
Warrington ..	182¼	1 31	1 26 35	54.5	175	
	Steam	off passing	Warrington Station			
Wigan	193⅞	1 45	1 40 45	48.2	160	
Uxton Junc.	203¼	1 58	1 53 50	42.8		
	Steam	off passing	Uxton Junc.			
Preston.. ..	209	2 6	2 4 35	30.6	175	
	Steam	off passing	Preston		175	
Lancaster ..	230	2 31	2 29 20	51.1	170	
Carnforth ..	236¼	2 38	2 35 35	60.0	175	
					175	
Oxenholme ..	249¼	2 56	2 52 40	44.2	175	
					170	
					170	
Tebay	262¼	3 16	3 13 20	37.8	175	
					170	
					170	
Shap Summit	267¼	3 27	3 23 50	32.2	175	
					170	
	Slowed to 50 m.p.h. for curve					
Penrith ..	281¼	3 42	3 38 30	35.3	175	
	Steam	off passing	Penrith			
Carlisle, arr...	299¼	4 2	4 1 0	47.6		

Pyrometer not in order.

subsequent descent to Carlisle were not high and the slow to 50 miles per hour nearing Penrith for the curve was very carefully observed. The regulator was for the most part only just open and the cut-off 20 per cent. This engine steamed very well with some very good coal; even so, an average pressure of 173 lb., the mean of seventeen readings, is a fine record. This is 98.8 per cent. of the maximum working pressure. Between London and Crewe this figure was 95.5 per cent.

The average speed between Crewe and Carlisle was 46.7 miles per hour. Between London and Crewe seven to ten shovels of coal were fired every two to three minutes, and between Crewe and Carnforth the firing was much the same. Between Carnforth and Shap Summit the firing rate was usually eight or ten shovels at a time every one and a-half to two minutes on the Grayrigg and Shap Banks. Throughout the entire journey both engines did all that was required easily with the use of one injector. The pyrometer on engine No. 2035 was not in order, hence I have no temperature records.

On the Crewe and Carlisle section, or the Northern Division, there are in all four sets of water troughs, the first being at Moore, about 2½ miles south of Warrington, and the others are at Brock, 7½ miles north of Preston; Hestbank, between Lancaster and Carnforth, about 3 miles south of the latter station; and the fourth set is just south of Tebay. This is the ninth and last set between London and Carlisle.

On the return trip from Carlisle to Crewe I travelled with the express leaving at 12.30 a.m. This train is the 10 a.m. ex Glasgow (Central) and is due at Crewe at 3.29 p.m., thus being allowed 179 min. for the 141¼ miles, which are run without a stop. The load behind the tender was very light, being six eight-wheeled corridor vestibuled W.C.J.S. coaches, and one twelve-wheeled diner, thirty axles, and weighing without passengers and luggage 221 tons. The engine was No. 103, one of the new "Claughton" type, built in April, 1920. The train arrived well up to time from the North, and we left right on time at 12.30.

Log No. 5.—*London and North-Western Railway.*

12.30 *p.m. ex Carlisle, Glasgow (Central) and London (Euston) Luncheon Car Express.*

Engine No. 103, four-cylinder, 4–6–0 type. Train weight and composition, six eight-wheeled cars and two twelve-wheeled cars, 281 tons.

Stations.	Miles.	Time. Booked	Time. Actual.	Speed m.p.h.	Steam press.	Steam temp.
		h. min.	h. min. sec.			
Carlisle ..	—	12 30	12 30 0	—	165	—
					170	
Wreay	4⅞		12 40 0	29.0	165	630
						640
Penrith ..	17⅞	12 58	12 58 20	42.5	170	640
					.5	650
					175	635
					175	635
Shap Summit	31¾	1 21	1 23 10	32.6	150	
Tebay	37	1 27	1 28 30	63.2		
					155	600
Oxenholme ..	50	1 41	1 41 0	62.5	170	500
					175	590
					165	
Carnforth ..	62⅞	1 54	1 54 15	53.4	170	
Lancaster ..	69½	2 1	2 0 50	57.1	175	620
Preston.. ..	90½	2 25	2 25 5	56.5	175	Steam off
					170	660
Leyland ..	94½	—	2 30 50	40.0	170	
					170	
Uxton Junc.	95⅝	2 38	2 33 0	43.6	175	630
Wigan	105½	2 45	2 45 15	47.2	160	
Warrington ..	116⅛	2 59	2 57 5	57.6	175	
					165	590
Crewe	141¼	3 29	3 27 40	48.2	—	

Leaving Carlisle the engine has immediately to face 31¾ miles of heavy climbing up to Shap Summit. From Carlisle up to Wreay, 4¾ miles, took 10 min., exactly representing 29.2 miles per hour. The regulator was one-third open and the cut-off 25 per cent. After Wreay the engine was notched up to give a cut-off of 20 per cent., and the reverse wheel was never touched again till steam was shut off for the Crewe stop. At mile-post 13½ the regulator was closed to one-quarter open and remained in that position till we passed Clifton and Lowther, 23 miles from Carlisle, at which point it was opened to one-third, and later, on reaching mile-post 25, it was further opened to two-thirds, and on passing mile-post 26½ it was three-quarters open. The average speed between Wreay and Penrith, uphill on grades of 1 in 228 to 1 in 186, was 42.5 miles per hour, and between Penrith and the summit, 13½ miles up hill, 7 miles at 1 in 125 and the last 2 at 1 in 106 and 1 in 130, the speed was 32.6 miles per hour. The steam pressure was 170 lb. at Penrith, and from there to the top of the bank was maintained at 175 lb., the nominal working pressure; the temperature of the superheated steam varied from 635 deg. to 650 deg. Fah. We passed Shap Summit 53 min. 10 sec. after leaving Carlisle, against 51 min., the time allowed. From Shap Summit to Tebay, 5⅛ miles down hill at 1 in 75, the speed with regulator just open was 63.3 miles per hour; we touched 66 miles per hour about the centre of the bank, and between Tebay down to Oxenholme the speed averaged 62.5 miles per hour. Passing over the water troughs at Tebay the fireman had to be particularly quick in letting down the scoop, as we were travelling very fast, and the water in the tank was low after the 30-mile climb to the summit from Carlisle, during which one injector had been in action almost continuously. We were slowed slightly by signals nearing Oxenholme, where we were exactly on time, and 12⅞ miles further, at Carnforth, passed at a pretty high speed, we were 15 sec. behind. At Lancaster we were 10 sec. early, and the train ran through Preston Station very slowly 5 sec. later than the scheduled booking of 2.25. The time from passing Shap Summit to passing through Preston was 61 min. 55 sec. for the 58⅝ miles.

Between Tebay and Carnforth the regulator was one-quarter open and from thence to Preston slightly more. The line rises from Preston up to Uxton Junction, and from there, after a slight drop, it is up hill again to a point about 1 mile beyond Coppull Station, which is about 9 miles from Preston. The principal rising grades are 1 in 314, 1 in 432, 1 in 114, and 1 in 246. With the regulator one-third open up to Leyland, 4 miles from Preston, and three-quarters open onwards, the engine passed Uxton Junction in 7 min. 55 sec., the speeds being to Leyland 40 and from thence to Uxton Junction 43.7 miles per hour. The train was just 5 min. early at Uxton Junction.

After passing Standish, situated the other side of Coppull Summit, the regulator was closed to one-quarter, and with the exception of when passing Wigan, when it was just open, it remained in that position until closed for the stop at Crewe, reached at 3 h. 27 min. 40 sec., at which time we actually came to a stop in the station, 1 min. 20 sec. before the booked arrival time of 3.29 p.m. Between Carlisle and Crewe the average speed was 47.8 miles per hour, and the average steam pressure, the mean of twenty-two readings, was 167 lb., equal to 95.5 per cent. of the standard working pressure. It is interesting to note that this figure is exactly the same as that obtained between Euston and Crewe on the down journey. The pyrometer reading varied from 500 deg. to a maximum of 660 deg., the former figure being shown passing Oxenholme with the regulator one-quarter open, the cut-off 20 per cent., and a steam pressure of 170 lb., whilst the latter figure was indicated between Preston and Leyland with the regulator a full one-third open, cut-off 20 per cent., and with the steam pressure 170 lb. The mean of thirteen readings of the pyrometer gave an average steam temperature of 617 deg.

These four-cylinder engines, like the other locomotives on which I have travelled having this number of cylinders, are very steady and comfortable to ride on, and the three "Claughton" class engines whose performance I have recorded steamed very freely and were exceedingly well handled by both the drivers and firemen. The loads, of course, were very light, which was unfortunate, for these engines should have at least 400 tons behind them at the average speed attained on the trips I have made. The heaviest load I had was between Crewe and Carlisle on the down journey, but it was only 287 tons, or 28 per cent. less than the figure I have mentioned.

These articles on London and North-Western locomotive work would hardly be complete without some reference to the excellent permanent way on which the trains travel. From London for the first 59⅞ miles to Roade there are four sets of rails. Roade is the junction for the Northampton loop line, and from there on to Rugby there are two sets of rails. Between Hilmorton, just north of Rugby, to Brinklow, about 5 miles, there are again four roads, the up and down fast lines being in the centre. From Brinklow to Attleborough there are only two roads, and thence to Tamworth there are again four, the up and down fast lines being in the centre. This length is about 19 miles. Four tracks do not appear again till Armitage is reached, whence to Colwich, 6 miles, there are four roads, the up and down fast lines being again in the centre. From Colwich to Milford and Brockton, 4 miles south of Stafford, there are two roads only, and thence to a point near Crewe there are again four roads, with the up and down fast lines side by side to the right; the four lines continue to Crewe, but the fast roads up and down again take the centre position. Between Crewe and Warrington there are two roads only, but from Warrington to Winwick Junction there are again four sets of rails, with the up and down fast line in the centre. This length is about 3¼ miles, and four roads do not occur again till Golborne Junction is reached, when there are four sets of rails to Wigan, about 6 miles, with the fast lines to the right.

The 12 miles from Standish to Preston is the next length, where there are four tracks, and, as on the previous section, the fast lines are to the right. The last section in which there are four tracks is from Greenbank Junction, Preston, to Barton and Broughton, about 4 miles, and on this length the up and down fast lines are in the centre. The relative positions of the fast and slow lines is described as being right or left looking in the direction of a train travelling on the down journey—that is, towards Carlisle.

The road is stone ballasted throughout, and the rails now used on the main lines weigh 95 lb. per yard and are rolled in 60ft. lengths to the British standard section.

Generally the signals are to the left of the road to which they apply, and when there are four roads those for the fast and slow lines are distinguished by the semaphores for the slow roads having circular discs or rings mounted on them. On the North-Western system there are, I believe, altogether 20,000 signals.

The "Claughton" and "George the Fifth" class engines which have formed the subject of this and the preceding article hardly require introduction to those conversant with modern power on the railways of this country. However, for the sake of completeness, and for those who are interested but who do not happen to be familiar with these engines, I give below a tabulated statement setting forth the leading particulars of these successful locomotive types.

	"Claughton"	"George the Fifth" (Two)
Class	"Claughton"	"George the Fifth" (Two)
Cylinders (four)	15½ × 26	20½ × 26
Drivers, diameter	6ft. 9in.	6ft. 9in.
Steam pressure	175 lb.	175 lb.
Tractive effort*	23,700 lb.	20,000 lb.
Heating surfaces—		
Tubes, sq. ft.	149 1⅝in. = 1087.9	168 1⅝in. = 1004.96
Flues, sq. ft.	24 5⅛in. = 486.3	24 5in. = 380.44
Fire-box, sq. ft. ..	171.2	161.75
Total, sq. ft. ..	1748.7	1547.15
Superheater, sq. ft. ..	379.3	302.50
Total equivalent, sq. ft.†	2317.5	2000.9
Grate area, sq. ft... ..	30.5	22.4
Engine weight in working order	77 tons 15 cwt.	59 tons 17 cwt.
Total weight, engine and tender	117 tons	99 tons 2 cwt.

* Mean pressure, 85 per cent. of the boiler working pressure.
† Equivalent heating surface equal to total evaporative surface plus 1.5 times the superheater surface.

The "Precursor" class locomotives fitted with superheaters are practically identical with the "George the Fifth" class, for it will be remembered by those who follow locomotive development on British railways that, with the exception of the addition of the superheater, together with larger cylinders having piston valves, and the introduction of "rockers" in the valve motion and extended smoke-boxes, the late Mr. Cooke's 4–4–0 type superheater engines were similar in other respects to the Precursors, which had hitherto done such excellent work on the London and North-Western.

In concluding, I have much pleasure in expressing my thanks to Captain H. P. M. Beames, Chief Mechanical Engineer, and to Mr. E. C. Trench, Chief Engineer of the London and North-Western Railway; to the former for his kindness in granting me the necessary facilities for making my footplate observations, and for supplying particulars of the new "Claughton" class engines, &c.; and to the latter for furnishing information relative to the excellent permanent way for which the London and North-Western is so justly famous.

EDUCATIONAL INTELLIGENCE.

Mr. Albert E. Webb, B.Sc., A.M. Inst. C.E., has been appointed Senior Assistant in the Department of Civil and Mechanical Engineering at University College, London, in succession to Mr. H. P. Philpot, who resigned in July, on being appointed Professor in the Finsbury Technical College. Mr. Webb will begin his duties in October.

University of London, University College.—The following are some of the public lectures to be given at University College during the Michaelmas term: "Einstein's Theory of Relativity," by Dr. G. B. Jeffery; "Recent Researches in Photo-elasticity," by Professor E. G. Coker, F.R.S.; "Geometry for Engineers," by Mr. A. T. Walmisley, M. Inst. C.E.; and "The Literature of Science," by Dr. A. Wolf. A full list of the lectures may be obtained by sending a stamped addressed envelope to the Secretary, University College, London, W.C. 1.

A Seven-Day Journal.

Engineering at Cambridge.

In resigning the Vice-Chancellorship of Cambridge University at a Congregation on Monday last, Dr. Peter Giles referred to the extensions which are in progress. The largest of the schemes which the University authorities have in hand at the present time is the new engineering laboratory, and the financial situation, as Dr. Giles explained, has been seriously complicated by the depressed state of the engineering industries. At a time when industry is practically at a standstill, it is fruitless to expect that large benefactions can be drawn from the great engineering firms, interested though many of them are in the progress of the engineering school. But it was not possible to suspend operations because the extension of the schools of physics and of chemistry is impossible till the engineering school is housed in its new quarters. The difficulty has been overcome by a piece of financial strategy, and it was ultimately agreed that from the Chemistry Endowment Fund should be paid £17,500 for the purpose of replacing on the new site the Hopkinson Memorial Wing of the Engineering Department, and that the same fund should lend free of interest for a period not exceeding five years a further sum of £15,000, on the understanding that the premises of the Engineering Department should be vacated by the end of December. A further sum of £15,000 remains to be found from other sources. Towards this amount there has been paid through Lord Esher from the University Association £4700, the Directors of Barclay's Bank have given £1000, and four other banks £250 each.

The Science of Business.

Those engaged in the conduct of industry were reproached by Sir Josiah Stamp in an address delivered to the Conference of Incorporated Accountants, held at Liverpool this week, for their neglect of statistics. He contended that business in this country depended for its next step forward upon the application of advanced statistical methods of sampling and correlation of the great mass of business data. Accountancy has, it is cheering to learn from this eminent authority, a monopoly of the information required, but having had sole possession of this priceless knowledge for a period of fifty years, has failed to produce therefrom a single generalisation as a contribution to economic science. A systematic effort by a small band of workers in the profession would, in ten years, we are assured, put the economics of industry on the basis of an exact science. We wonder. There are many who differ from this caustic critic of the profession of accountancy, who was roundly accused, indeed, of blaming the accountant for the failure of the economists to make use of the knowledge available. The task outlined by Sir Josiah Stamp was held to be the responsibility of those engaged in the conduct of industry. There is a great deal to be said on this side of the argument.

Moving Pictures which Speak.

After a great deal of experimenting, a demonstration has just been given in London of the moving-picture which combines sound with motion. The latest device is a British invention, and at the test which took place a few days ago in London with the dual record on a single negative, Mr. Grendell-Matthews, who is responsible for the method by which this is achieved, showed that he has made a great improvement on the technical side of kinematography. The sound recorder can be used in conjunction with the ordinary camera used for taking motion pictures. The sound vibrations are picked up by electrophones and transferred to the negative by reflection. Reproduction is obtained by using pencils of light in a manner which was suggested to the inventor by searchlight research work upon which he was engaged at the Admiralty during the war period. The advantage of the new method of sound pictures over a recent Swedish invention is that the latter requires the use of two cameras, two projectors, and, of course, two separate films. The British invention makes use of one camera and one film only.

Steel Trade and American Tariff.

What will be the effect of the protest made before the Senate Finance Committee as to the effect on the Sheffield steel trade of the proposed new American tariff it is difficult to say. The agitation against the provisions of the Fordney Bill is, however, to be continued. The report made by the delegates, Mr. Arthur Balfour, Mr. S. T. Robinson, Mr. Peter McGregor and Mr. J. C. Ward, on their return to Sheffield this week, indicated that a serious attempt was made to influence American public opinion against the new tariff. In addition to being received by the Finance Committee of the Senate, the delegates visited Pittsburg, Cleveland, Chicago, Detroit, New York, Boston, and other cities. The new tariff, which is held up for revision and may not be reconsidered before next February, would probably kill the trade which Sheffield transacts with America in high-speed steel. It is satisfactory to learn, therefore, from Mr. Balfour and other members of the delegation that public opinion in the United States is growing hostile to the Bill. An appeal is made that British industries other than the steel trade whose interests would be affected by the proposed new tariff should continue the propaganda work initiated by Sheffield manufacturers.

Centenary of John Rennie.

It is one hundred years this week since John Rennie was laid to rest in Westminster Abbey—a distinction accorded to but few engineers. The son of a Scottish farmer with no influence to smooth his passage to the highest place in the profession, Rennie demonstrated at a comparatively early age his bent for dock and harbour design and bridge work. He was responsible for dock developments at Liverpool, Hull, Leith, and some lesser ports, and he was the creator of many notable bridges. Of those spanning the Thames, Waterloo Bridge, which has been justly acclaimed as one of the most beautiful in the world, is the best known, but it should not be forgotten that the new Southwark Bridge replaced a hundred-year-old Rennie structure. One or two other bridges designed by him persist. Fen drainage schemes also occupied his attention, and, in common with other engineers of his day, Rennie was engaged in canal construction. The first John Rennie—his son was also, of course, a distinguished engineer, who was knighted for his attainments—will, however, be mainly remembered as a great bridge builder.

Presentation to the U.S. Navy Construction Corps.

Commander E. S. Land, of the United States Navy Construction Corps, who has been Assistant Naval Attaché in this country for the past two years, is returning to America next week. On Tuesday last the members of the Royal Corps of Naval Constructors entertained him and his successor, Commander E. C. Hamner, at luncheon at the Carlton Restaurant. Later, the Director of Naval Construction presented him with a golf trophy for competition amongst the members of the United States Navy Construction Corps. In making the presentation, Sir Eustace d'Eyncourt expressed the hope that it would be a reminder of the friendly co-operation between the Construction Corps of the two countries which led to such happy results during the war. In accepting the trophy, Commander Land expressed the opinion that the mutual regard won during those times could never be obliterated, and that anything which tended to cement the friendship and cordial relations between the two countries could not fail to be for the benefit of civilisation and world-wide peace.

The R 38 Disaster.

So far as any information elicited at the resumed inquest on the victims of the R 38 disaster is concerned, we are no nearer a satisfactory explanation of the cause which led to the disaster of August 24th. Messrs. Gerrish and Evans, of the Royal Airship Works, who were intimately concerned with the construction and design of the vessel, were examined by the coroner, but could throw no light on the failure. Mr. Evans, indeed, stated that at no conference following the earlier trials which he attended was any doubt expressed as to the constructional strength of the vessel. Mr. Bateman, of the National Physical Laboratory, one of the five survivors, was likewise unable to express any opinion on the cause of the disaster. He made it clear, however, that the failure occurred when the vessel was flying at 50 knots, and about 20 min. after a full speed 60-knot test had been completed—the first full-speed test to which the vessel had been subjected. Aircraftsman Davies said that he was in the keel at the time of the disaster and when walking forward suddenly found a yawning gap in front of him. The Captain, Lieutenant-Commander Wann, as a result of a relapse, was too ill to attend the inquest. It is thus apparent that we must await the publication—if publication be decided upon—of the Air Force's Technical Committee's report before we can hope for any satisfactory explanation of the catastrophe.

Richborough Ferry and Goods Traffic.

It has been anticipated, since Richborough was acquired by strong commercial interests and the railways got out of the grip of Government control, that an attempt would be made to re-open the ferry for goods traffic. Much interest has therefore been aroused by the announcement that a trial trip of a through goods train from Paris *viâ* Calais and Richborough to the Southwark goods station of the South-Eastern and Chatham Railway is to take place on Tuesday next. It is hoped to secure the presence at Southwark on the arrival of the train of the French Ambassador and other public men interested in Anglo-French trade. A hint has been thrown out that serious consideration will be given, if the trial trip proves successful—and there is no reason to anticipate any disappointment—to the inauguration of regular passenger and goods services.

R 38 Memorial Fund.

The Council of the Royal Aeronautical Society has decided to establish a fund as a memorial to those lost in R 38 and previous airships. With the income derived from the capital sum raised, it is proposed to encourage investigations into problems connected with airships or allied subjects. The results of such work will be embodied in papers to be read before the Royal Aeronautical Society. It has been decided that the memorial shall take this form, as it is believed that it offers the best means of carrying on the work of those who have perished in the cause of airship development. The Government has decided to suspend all work on airships, and is making no provision for experiment or research, and the Council of the Royal Aeronautical Society feels that unless Great Britain is to drop completely out of the race for commercial airship supremacy, investigation must be carried on, even though on a small scale. It therefore appeals for subscriptions to the fund, from which it is hoped to be able to provide an annual grant towards the carrying out of some specific research, the nature and importance of which must of necessity depend largely upon the money available.

Plain Words from Mr. Hichens.

In the address which he delivered on Tuesday afternoon to the members of the London Iron and Steel Exchange, Mr. W. L. Hichens faced the industrial situation with clear courage. He did not hesitate to say that wages must come down irrespective of the cost of living, which is now an impossible standard. In any event this authority regards it as unlikely that costs of production can for some time be reduced to the level of selling prices, and he warned capital that it must accept the obligation of tiding industry over the period of crisis. Mr. Hichens had come fresh to this meeting from a conference with the Prime Minister at Gairloch, and although his lips were sealed as to what had happened, he warned his audience that however much might be done by the State to deal with the evils of the present situation, the main burden of the task of nursing a sick Europe back into a state of convalescence must be undertaken by employers and employed. He sent out an appeal to the trade unions for co-operation in the work, but their officials are still engaged in a vain effort to avert the cutting off of war bonuses.

Power Alcohol Developments.

Speaking at the Conference of the Commercial Motor Users' Association at Bristol on Wednesday, Mr. E. S. Shrapnell Smith referred to the use now being made of home-produced power alcohol in active service. One firm was now, he stated, running its commercial vehicles on a mixture of petrol, power alcohol and benzol in the proportion of about one-third of power alcohol, which was to be regarded as the line of development in connection with its use which would be followed in the immediate future. The relief in respect of duty has, of course, given great encouragement to the production of power alcohol from home resources, and concurrently a great deal of research work is in progress. Mr. Ricardo, who has been giving special attention to this side of the subject, has only this week presented a second report of an exhaustive character, the contents of which, at least in the form of a summary, will, it is hoped, be available in the near future.

Air Speed Record.

The air race held at Etampes for the Deutsch de la Meurthe Cup resulted in a win for Kirsch, a French pilot, who covered 300 kilos. in 1 hr. 4 min. 39 1-5 sec., giving a mean speed of 174 miles per hour. There were two forced landings, one being the result of a propeller breaking in mid-air, and the other—the victim being the only British representative in the race—being due to the swelling of the aeroplane canvas to a degree which threatened disaster. The technical interest of the race lies in the fact that at the high speeds attained new factors in design and construction are introduced to which careful consideration must be given.

Future of Ministry of Transport.

It is doubtful what will be the fate of the Ministry of Transport. Sir Henry Maybury, while expressing ignorance whether it will remain a Ministry or be reduced to the level of a mere department, expressed the belief that both in connection with the future of roads and railways it could render important service to the public. He claimed that one of the tasks carried out by the Ministry—the grouping of the railways—was the biggest ever undertaken by any Government department.

The Shipping and Engineering Exhibition.

No. V.*

Sluice Valves.

Some novel valves were shown on the stand of the Clayton Valve Company, Ltd., Blackpool, and three of them are represented in the sketches, Figs. 53 and 54, and the half-tone engraving Fig. 55. From Fig. 53 it will be seen that the valve is so arranged that the direc-

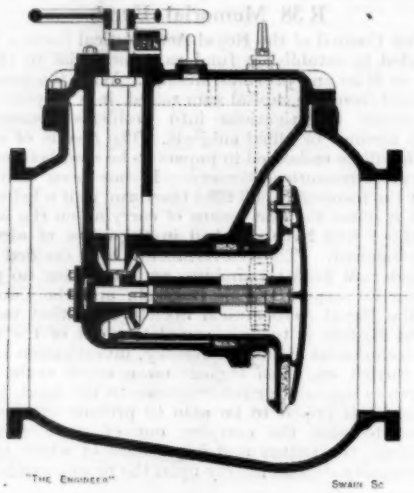


FIG. 53—CLAYTON VALVE

tion of motion of the fluid is not changed materially as it passes through, with the result that there is a minimum loss of pressure. The valve itself is built up with a rubber disc for cold water or a phosphor-bronze head for such services as boiler feeding. It is moved up to its seating by the screw and bevel

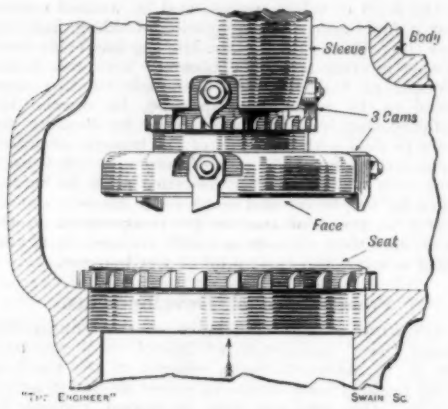


FIG. 54—SELF-ROTATING JUNCTION VALVE

gear shown, and does not rotate as it advances. The screw and gear are arranged in a hollow casting which is filled with oil or grease. This casting forms the cover of the valve and can be taken out bodily for overhauling. The joint between the valve stem and the hollow casting is made by means of a stuffing-box which can be adjusted from the outside in the larger sizes. In the case of the smaller valves it is necessary to take out the internal parts to get at the stuffing-box. One of these valves, which was intended for a pressure of 100 lb. per square inch, was tested at the National Physical Laboratory, Teddington, to a water pressure of 300 lb. without leaking at all.

Another new valve, by the same makers, has an automatic arrangement for moving it round on its seating and is intended for such purposes as boiler junctions. The essential parts of the rotary mechanism are shown in Fig. 54, from which it will be seen that the valve disc is provided with two sets of catches or cams. These catches engage with two annular sets of teeth, one on the seating and the other on the sleeve which surrounds the spindle. The several parts are so proportioned that each time the valve is opened and closed the valve is moved round a space by the catches sliding over the teeth. The result is, of course, that there is a tendency for the valve to bed down evenly on its seating. The screwed spindle of these valves is completely protected from the action of the steam and from dirt by a sleeve of stainless steel.

The valve shown in Fig. 55 is of quite a different type and is designed to give a straight way through, while provision is made for substituting a new valve disc in the event of the one in service being damaged. Three valves are provided and are arranged round a large disc, which is placed with its axis parallel with, but excentric to, the bore of the pipe. The disc is, of course, enclosed by a casing and is mounted on a spindle passing through a stuffing-box. In the quadrant not occupied by either of the valves the disc is pierced with a hole of the bore of the pipe. It will be readily appreciated that by turning the disc the valve can be opened or closed, and that if one of the valve faces should become leaky, through scoring or any other cause, there are two alternative faces to fall back upon. Cam faces are so arranged on the disc that the valve is drawn away from its seating before it is rotated in order to prevent the faces from being damaged by rubbing.

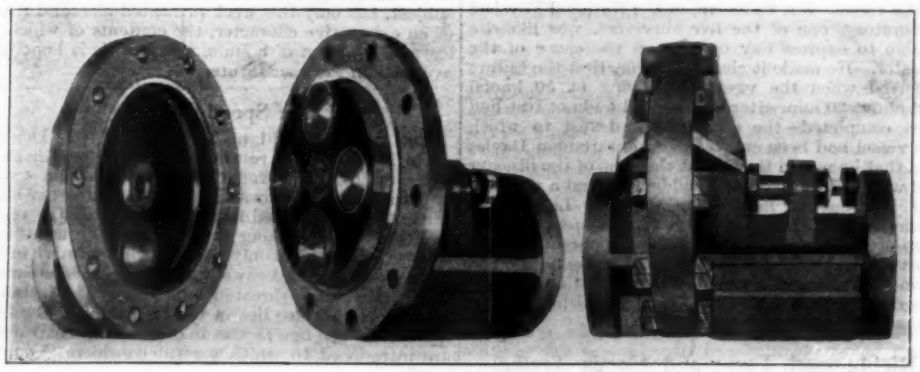


FIG. 55—RENEWABLE DISC FULL-WAY VALVE

Switchgear.

There were many more or less novel exhibits in the form of switchgear on the stand of the Igranic Electric Company, Limited. The "Auto Reclose" circuit breaker shown in Fig. 57, for example, is a

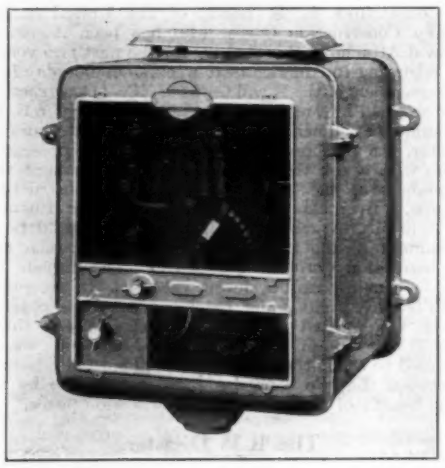


FIG. 56—JUNIOR UNIVERSAL CONTROL PANEL

piece of apparatus which ought to be inspected by those who are interested in the protection of electric motors. This breaker opens and closes automatically according to the working conditions. When a short circuit occurs it opens in the ordinary way, but it will not close until the overload or short circuit has been removed. In all cases there is a definite interval between the time the breaker opens and closes, and this interval can be adjusted at will. When several circuit breakers are used in connection with a generator the adjustment becomes a valuable feature, as the various breakers can be set so that the supply circuits are connected up to the bus-bars in the proper sequence and the generator is able to pick up its load under the best conditions. In the event of the voltage failing, the breakers open automatically, and it will therefore be seen that full protection is given to the installation under all working conditions. The makers point out that when hand-closed circuit breakers are used and overloads are frequent there is a tendency for the switchboard attendant to set the trip far too high or to prevent it acting at all, but with this automatic reclose breaker the human element is entirely eliminated. Various automatic devices have been devised for use with these circuit breakers. For instance, in automatic sub-stations a thermostatic relay can be made to open the circuit breaker in the event of the bearings of the machinery getting hot. The breaker can also be opened by an over-speed device fitted to a rotary converter shaft, and various other special arrangements of this sort can be adopted. For starting and controlling the speed of electrically driven machine tools the Junior universal switch panel shown in Fig. 56 has been devised. This type of panel, which is made for use with motors ranging from ¼ to 3 horse-power, is fitted with a self-acting starter of the solenoid operated multiple finger type. The fingers are mounted on a revolving shaft which is operated by the solenoid and timed by an adjustable dashpot. When the motor is being started the fingers close and cut out the resistance sections in succession, whilst the field of the motor is fully energised. A shunt field regulator with fifteen contacts and an external

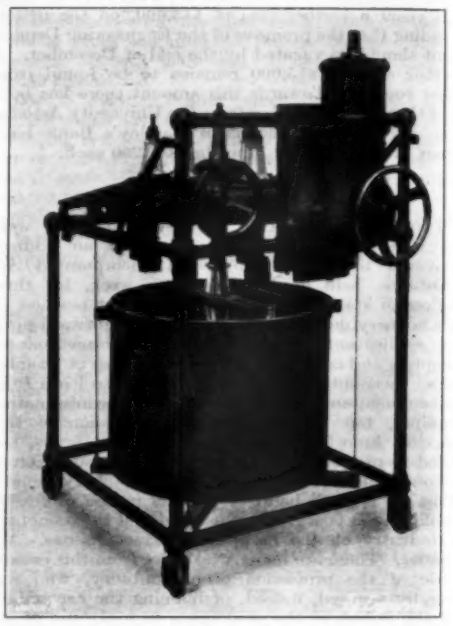


FIG. 57—IGRANIC AUTO RECLOSE CIRCUIT BREAKER

operating handle is provided for the purpose of varying the speed. There is also a magnetically operated circuit breaker or clapper switch, which is interlocked with the starter in such a manner that the circuit is always opened and closed on the breaker contacts and not on the starter contacts. A powerful magnetic blow-out serves for extinguishing the arc. A double-pole main switch is used for isolating the starter when the latter is in the "off" position. The whole of the switchgear is contained in a cover with a drip-proof ventilating hood, but the front and sides can easily be removed to facilitate the cleaning and examination of the working parts. The switch can be operated by one or more push buttons fixed at convenient points on the machine. Among other exhibits there was one of the company's unit type battery charging panels, a pillar type motor starting panel, and an automatic contactor type starting panel for starting induction motors.

Galvanising Plant.

On the stand of the Galvanising Equipment Company, Limited, of Rosebery-avenue, N. 17, the company's standard equipment for rustproofing small iron and steel articles was shown. This company was formed only two years ago, but already we are informed it has found it necessary, in order to meet the demand for its process, to build large works at Tottenham with a capacity for the treatment of 10 tons of material daily. In addition, it has entered into an arrangement with a Glasgow firm which now deals in its own works with all business originating in Scotland. The "Galeco" rustproofing process makes use of a special zinc alloy. A detailed description of the process and plant was given in our issue of November 26th, 1920, in connection with our account of the Shipbuilding, Engineering and Electrical Exhibition at Glasgow.

Electric Trucks.

Of the trucks that were exhibited by British Electric Vehicles, Limited, of Churchtown Works, Southport, the 2-ton vehicle shown in Fig. 58 was perhaps the

* No. IV. appeared September 30th.

most attractive. It has been built to suit the requirements and rough usage of docks, warehouses, and engineering shops, and it is said to be very easy to handle. In the design of the vehicle an endeavour has been made to reduce the number of working parts to a minimum, so as to minimise the number of spares. Moreover, all the working parts can easily be inspected. The wheels can be detached without interfering with the roller bearings, brakes or gearing, as they are merely pushed on to the hubs and fixed by studs. Similarly, the countershaft or driving motor can be detached without dismantling any other portion of the vehicle. The control system is foolproof. Immediately the brake is applied the current is cut off automatically, and before the current can be switched on again the controller handle must be brought back to the neutral position. The loading space measures 7ft. 6in. by 4ft. and the wheel base 5ft. The turning radius is 7ft. measured from the centre of the wheel track, which is 3ft. 4¼in. wide. Heavy rolled steel channels having a section of 4in. by 2in., cross stays, and gusset plates are employed in the construction of the frame, and webbed brackets are provided for carrying the axle pins. The roller bearings upon which the wheels are mounted are of the Timpken type. Tires 20in. by 3½in. are fitted to the wheels. For steering a horizontal lever is provided, and the steering is done by moving the lever vertically either up or down. A battery composed of twenty cells with a capacity of 161 ampère-hours provides the working current. The cells are slung in a cradle which is suspended on cantilever springs. Power from the motor is transmitted to the road wheels by means of a countershaft and differential, which is coupled to the motor through spur gear.

The same type of gear is used for coupling the countershaft to the road wheels. Skefko self-aligning ball-bearings are used for supporting the countershaft and differential, and the design is such that the whole of the countershaft can be removed without the least difficulty. The Ferodo-lined brakes, which are of the double shoe external type, operate on drums attached to the driving wheels. Under the platform at the driver's end of the truck the main controller is mounted, and it is operated in conjunction with the patented trip gear, which makes it impossible for the truck to be started unless the controller is brought back to the neutral position. The small electric locomotive shown in Fig. 59 is another exhibit well worthy of mention. It is designed to haul a load of 10 tons on the level or about 3 tons on a gradient of 1 in 30. The weight of the engine complete with the battery is 2 tons 5 cwt. With a single battery charge the vehicle will cover, when loaded, a distance of from 20 to 25 miles on the level at a speed of 3½ miles per hour, and when unloaded the speed is about 5 miles per hour. The standard battery, which is manufactured by the Chloride Electrical Storage Company, Limited, is an Ironclad Exide battery composed of twenty-four cells and having a capacity of 193 ampère-hours. The cells are mounted in hardwood boxes, provided with handles. If desired, Edison or other cells can be fitted. The main frame of the engine is composed of cast iron. A drum type controller capable of carrying 100 ampères continuously gives three speeds in either direction. The 2ft. 6in. wheel base is specially arranged for negotiating sharp curves, the minimum radius being 11ft. The engines are built for any gauge from 18in. upwards and are guaranteed for a period of twelve months. The overall length varies with the gauge. For all gauges up to 2ft. 6in. it is 6ft. 4½in. and for all gauges from 3ft. up to 5ft. 11in. it is 5ft. 11in.

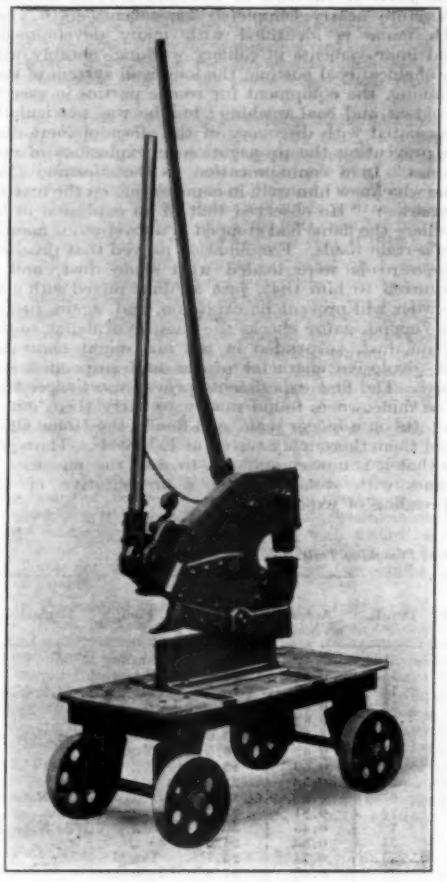


FIG. 60—COMBINED PUNCHING AND SHEARING MACHINE

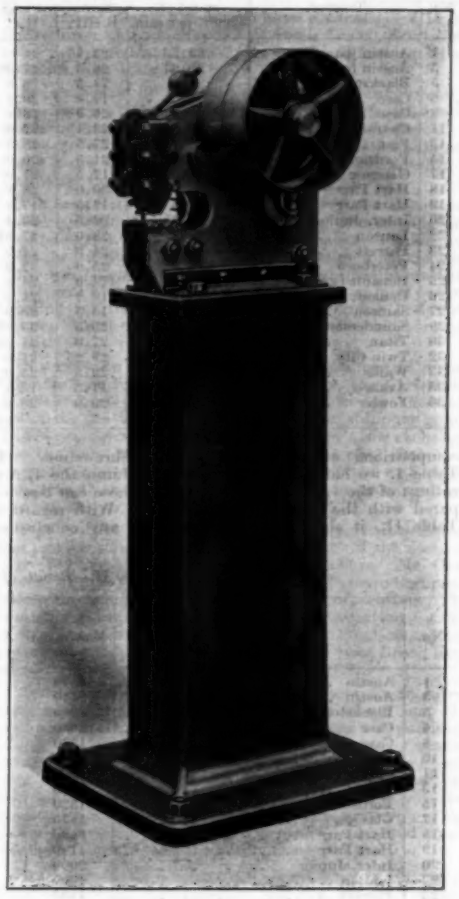


FIG. 61—BELT-DRIVEN PUNCHING MACHINE

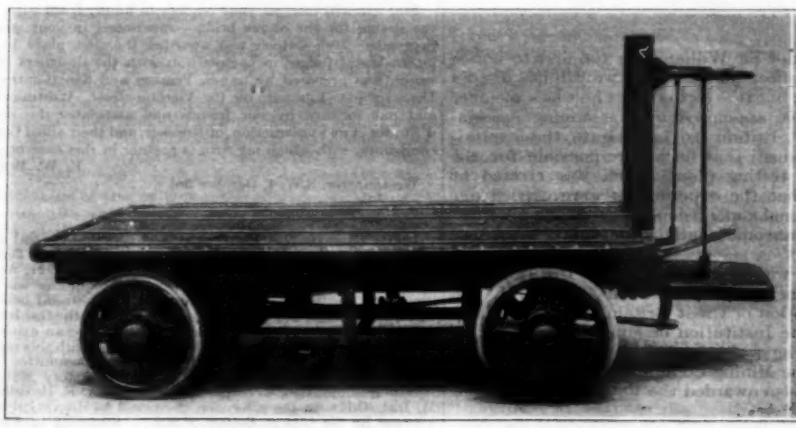


FIG. 58—TWO-TON ELECTRIC TRUCK

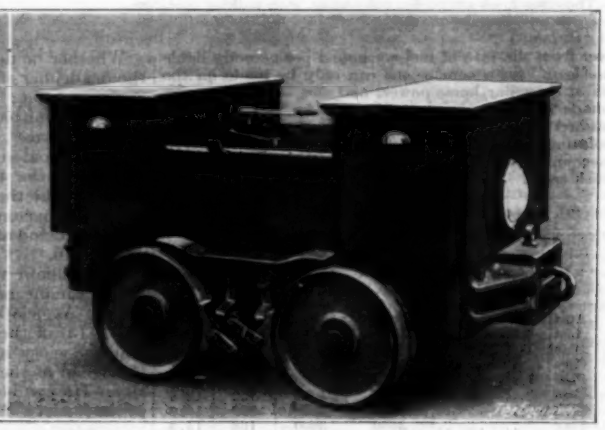


FIG. 59—ELECTRIC LOCOMOTIVE

Other firms exhibiting electric trucks were W. Goodyear and Sons, Limited, of Dudley, and Industrial Appliances, Limited. The Greenbat electric truck made by the former firm was described in our recent series of articles on "Electric Trucks and Industrial Locomotives;" also the Railadock truck supplied by Industrial Appliances, Limited.

Punching and Shearing Machines.

On the stand of C. A. Hunton and Sons, 110, Bishopsgate, London, E.C. 2, there were the two handy little machines for sheet metal work which are illustrated in Figs. 60 and 61. The first is a combined punching and shearing machine, for hand work, which is capable of making a ¼in. hole through ⅜in. iron plate, and of shearing through the same thickness. It will be noticed that the frame is offset so that continuous cuts can be made with the shear. The overall dimensions of the machine are 2ft. 3in. by 2ft. by 7in., and it weighs 2 cwt. 3 qr., while the trolley on which it is mounted weighs another hundredweight and a-half. The punching machine, it will be seen, is for power driving, and will drive a ⅜in. punch through 5/16in. plate, while there is room in the gap, which is 4in. deep, for dies up to 1½in. diameter if thin gauge material is being worked. It runs at such a speed that forty holes can be punched per minute, and requires 1¾ horse-power. Another new tool on this stand was a rod cutter for bolting to the bench. It only weighs a few pounds, but will cut off stock up to ½in. diameter and leave a nice clean end.

Hydraulic Presses.

Hollings and Guest, Limited, of Birmingham, were exhibiting some representative types of hydraulic machinery, including a tire-fitting press for removing and fixing the solid rubber tires of commercial vehicle wheels. This press is said to be capable of dealing with the largest and heaviest makes of tires, and will give a pressure of 200 tons. It can be worked very well by the double hand pumps usually supplied as part of the unit, but in large garages where there is a great number of tires to deal with, it is usual to put in power-driven pumps. The framework of the press is of the steel girder type. It is also fitted with a special runway, which picks up the wheels and carries them right into the press. The same firm also makes a special tire press with an open slot head designed to deal with the tires of Foden and similar wheels without taking the wheel from the axle. Another exhibit was a press for bending plates, cold, up to 6ft. in width, for such work as safe bodies, tanks, conveyors, colliery tubs, and so forth. The press has a swinging column at one end, so that when a complete body or shape has been pressed the column can be swung out, and the finished article slipped from the end of the press head. Tools of any shape can be fitted and are easily changed, so that shapes of various kinds can be bent. These presses are made to deal with plates of all sizes, varying from 2ft. to 20ft. in width. For the purpose of driving the machine, which, by the way, was shown in operation on the stand, a set of two-throw hydraulic pumps is supplied. These pumps are of the vertical two-throw type, built up on a bed-plate, and are driven by means of chain gears direct from an electric motor, which gives a very quiet and efficient drive.

The greater portion of the third and fourth rail required for the London and North-Western electrical service into Euston has now been laid. The present appearance of the work generally suggests that the new trains will be running early next year.

Agricultural Tractor Trials.

We append herewith the results of the tests carried out by the officials of the Society of Motor Manufacturers and Traders on the agricultural tractors in the recent competitions at Shrawardine, near Shrewsbury. In Table I. we have added in the last column the R.A.C. ratings of the various engines, so that these can be compared with the belt horse-power tests. With regard to Table II., it should be remarked that any conclusions drawn from the rate of fuel consumed per acre are liable to mislead. Such conclusions can only be made on the basis of draw-bar horse-power, and this comparison will be made in the final report of the judges which will be published shortly. We have already referred to the disappointing results of the draw-bar tests set out in Table III. on account of the poor adhesive qualities of the road gear in most cases.

Table I.—*Results of Belt Test.*

No.	Tractor.	B.H.P. at belt speed of 2200ft. per min.	Maximum. B.H.P.	R.A.C. rating. H.P.
1	Austin (paraffin) ..	23.25	23.75	—
3	Austin (petrol) ..	25.2	26.5	27.39
5	Blackstone	24.3	24.3	23.8
6	Case	10.5	14.5	20.4
8	Case	20.0	26.5	28.4
11	Cletrac	20.5	23.1	22.8
13	Fiat	26.2	27.5	28.5
15	Fordson	16.0	21.5	20.0
17	Glasgow	17.5	17.5	27.0
18	Hart Parr	28.75	30.0	28.8
19	Hart Parr	17.5	17.5	17.8
20	Inter. Junior	21.5	22.5	23.4
22	Lauson	28.0	28.0	27.84
23	Parrett	22.3	24.9	24.3
24	Peterboro	24.0	25.0	32.2
25	Renault (wheel) ..	21.5	24.0	24.5
26	Renault (track) ..	18.6	19.2	24.5
27	Samson	15.5	15.5	22.9
29	Saunderson	22.0	23.5	25.57
30	Titan	27.0	27.0	21.9
32	Twin City	25.25	29.25	31.6
33	Wallis	25.0	29.5	25.0
35	Avance	11.5	11.5	13.4
36	Fowler	19.25	20.0	23.0

Table II.—*Results of Observed Ploughing Tests.*

No.	Tractor.	Maximum pull.	Average pull.	Depth.	Acres an hour.	Fuel used per acre, pints.	Fuel.	Remarks.
1	Austin	1980	1720	5¾	0.49	24	Paraffin	
3	Austin	2440	1920	5½	0.51	23	Petrol	
5	Blackstone	1200	1070	7½	0.62	15.7	Paraffin	
6	Case	2060	1840	5¾	0.46	18	,,	
8	Case	1780	1370	7½	0.82	19.8	,,	
10	Case	3240	2485	6	1.11	23.6	,,	See Note 1
11	Cletrac	1900	1780	5¾	0.59	26.5	,,	
13	Fiat	2500	1650	7	0.69	15.3	,,	
15	Fordson	1320	1230	5½	0.58	23.5	,,	
17	Glasgow	1870	1630	6	0.54	18.8	,,	See Note 2
18	Hart Parr	2590	2240	7¾	0.81	33	,,	
19	Hart Parr	1190	910	7	0.45	30.2	,,	See Note 2
20	Inter. Junior	2000	1320	5½	0.53	24.6	,,	
22	Lauson	1600	1210	5½	0.74	25.7	Petrol	
23	Parrett	1880	1370	7	0.62	17.8	Paraffin	
24	Peterboro	2680	1665	7	0.77	24.5	,,	
25	Renault (wheel)	1460	1010	7½	0.79	18	Petrol	
26	Renault (track)	3420	2740	5	0.64	17.6	,,	See Note 1
27	Samson	1488	1072	5½	0.42	24.4	Paraffin	
29	Saunderson	1500	1030	7½	0.67	20.6	,,	
30	Titan	1700	1440	6½	0.68	25.5	,,	
32	Twin City	1645	1540	5½	0.71	27	,,	
33	Wallis	1800	1200	6½	0.78	19	,,	
35	Avance	—	—	6½	0.37	26.2	Crude oil	See Note 3
36	Fowler	—	—	6	0.36	45.3	Petrol	,, 4
39	Service	—	—	6	0.12	12.9	,,	,, 5
40	Simar	—	—	4	0.19	25.6	,,	,, 5

1. These tractors hauled two three-furrow ploughs.
2. These tractors had plots of awkward shape, which caused loss at headlands.
3. This tractor, although designed as a self-contained motor plough, hauled a separate implement.
4. This machine is a self-contained motor plough.
5. These machines are garden cultivators, with walking operators.

Table III.—*Results of Draw-bar Tests.*

No.	Tractor.	Pull to skid wheels, lb.	Sustained pull, lb.	Speed in feet per min	Draw-bar H.P.
1	Austin (paraffin) ..	2000	1820	215	11.4
3	Austin (petrol) ..	1920	1700	206	10.6
5	Blackstone	4060	3470	125	13.2
6	Case	2090	1710	161	8.4
8	Case	3660	2680	167	13.6
10	Case	5080	4080	152	18.8
11	Cletrac	2940	2650	225	18.0
13	Fiat	3500	3000	168	15.3
15	Fordson	1750	1385	175	7.35
17	Glasgow	2900	2450	166	12.3
18	Hart Parr	2870	2445	225	16.7
19	Hart Parr	1860	1580	175	8.4
20	Inter. Junior	2200	1700	143	7.4
22	Lauson	3160	2400	141	10.3
23	Parrett	3480	3140	135	12.8
24	Peterboro	3950	3300	157	15.7
25	Renault (wheel) ..	2400	2040	150	9.3
26	Renault (track) ..	4840	3620	130	14.3
27	Samson	1820	1500	130	5.9
29	Saunderson	3080	1930	138	8.1
30	Titan	3430	2760	156	13.1
32	Twin City	3000	2470	175	13.1
33	Wallis	2750	2560	181	14.0
35	Avance	2700	2450	86	6.4
36	Fowler	2040	1690	124	6.4
39	Service	480	410	60	0.75

In every case the draw-bar pull was limited by the adhesion obtained with the type of spuds or grips which were fitted to the wheels, and the nature of the ground, which was hard and dry.

Whether or not Sir William was the first to notice the deadening effects of inert dust we will not discuss at the moment; but it is certain that he was a member of the Committee appointed by the Mining Association of Great Britain to investigate the explosibility of coal dust, that he was responsible for the design of the testing plant which was erected at Altofts, and that the experiments were carried out under his personal supervision. The results obtained were discussed at some length in our issue of December 16th, 1910.

Sir William was a member of the Institution of Civil Engineers; Past President (1907) of the Mining Association of Great Britain; Past President (1911–13) of the Institution of Mining Engineers, by which Society he was awarded its first medal; and Chairman of the Mining Committee at Leeds University. He was also awarded the Fothergill Gold Medal of the Society of Arts.

Standard Tramway Axles.—The British standard specification for tramway axles (No. 102–1921), which has just been published by the British Engineering Standards Association, follows very closely the lines of the revised British standard specification for railway carriage and wagon axles (with analysis) which is included in Part 1 of the new edition of Report No. 24. A percentage of .05 of phosphorus or sulphur is permitted in the steel, as in the case of the railway axle specification, but for the manufacture of tramway axles no particular process of steel making is specified. Falling weight, tensile and cold bend tests are required, the latter being for use only where the order is for a number of axles under fifteen, when it is to take the place of the falling weight test. A diagram is included illustrating the method of performing the cold bend test. Normalising, of which a definition is given, or oil treating is specified, the choice to lie with the purchaser. The specification may be obtained from the offices of the British Engineering Standards Association, 28, Victoria-street, S.W. 1, or from Crosby Lockwood and Son, Stationers' Hall-court, E.C. 4, price 1s. 2d. post free.

Obituary.

SIR WILLIAM E. GARFORTH.

The mining industry has suffered a severe loss in the death of Sir William Edward Garforth, which took place at his home, Snydale Hall, at Pontefract, on the 1st inst. Sir William, who was the son of the late Mr. William Garforth, of Dukinfield, Cheshire, was born at the end of December, 1845, and had therefore nearly completed his seventy-sixth year. His name is identified with many developments and improvements in colliery working, notably with mechanical coal cutting, the long wall system of coal winning, the equipment for rescue parties in case of accident, and coal washing; but he was particularly associated with discovery of the effect of inert dust in preventing the propagation of explosions in coal mines. In a communication to the *Morning Post*, one who knew him well, in commenting on the matter, remarks: "He observed that in an explosion in his colliery the flame had stopped in a mysterious manner on certain roads. Examination proved that precisely these roads were loaded with shale dust, and it occurred to him that, just as dust mixed with gunpowder will prevent its explosion, and, again, just as fine copper gauze checks the passage of flame, so fine stone dust, suspended in the air, might neutralise the explosive character of gas and suspended coal dust. The first experiments proved most successful. The mineowners found money to carry them out at Altofts on a bigger scale, and finally the Home Office had them thoroughly tested at Eskmeals. The result is that it is now compulsory to dust the passages in mines with stone dust, as a preventative of the spreading of explosions."

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

BRITISH AND FOREIGN ENGINEERING.

Sir,—We desire to make a protest against the custom, unhappily too common, of citing the productions of continental countries as representative of the most advanced practice in engineering, and ignoring the fact that examples of similar or better practice may also be found in this country.

For example, Dr. S. P. Smith, in a British Association paper on large electric units, reprinted in your issue of September 16th, draws his examples of large internal combustion engines for power generation entirely from continental firms, making no reference whatever to the engines of these types made by British firms.

We are afraid that this is merely one instance of a very prevalent tendency to ignore or even belittle British engineering progress. Surely in a paper read under the auspices of the British Association, at any rate, some indication should be given that continental firms are not the only ones to whom one must go for examples of large gas and oil engines.

For the writer of a paper such as the one mentioned to be unaware that there are British firms who build large internal combustion engines is most regrettable. One need only consult the columns of the engineering Press for the last few years to realise that British firms are not inactive in this direction; yet, judging from the list of firms whom Dr. Smith quotes as supplying information for his paper, he does not seem to have even approached British makers of gas and oil engines for this purpose.

While we do not in any way wish to decry the skill and enterprise of foreign engineers, we do think that many British writers on engineering subjects, by directing attention to foreign rather than to British achievements, are conveying a false impression as to the state of engineering progress in this country, and doing thereby an injustice and possibly an injury to British engineering.

Galloways Limited,
H. Pilling,
General Manager.

Manchester, September 26th.

WAGES AND THE COST OF LIVING.

Sir,—With reference to the Ministry of Munitions bonus reduction, in your Seven-day Journal of last week's The Engineer, page 343, it may be pointed out that whilst this reduction will undoubtedly be a factor in the obtaining of new business, all employers should realise that it is by no means justified by the fall in the cost of living, as apparently the Federation has already realised.

Therefore, it is up to them to try and minimise the hardships this reduction will cause in many cases, and especially in big towns where it is impossible for all employees to go home for all meals. In many cases the establishment of co-operative canteens, partly financed by the employers, would be the means of effecting a substantial saving in the employees' living expenses. Restaurants and eating-houses at the present day, although apparently slightly cheaper than during the war, are, when the charges are analysed, in proportion to the amount of food supplied, undoubtedly no cheaper.

Co-operation in the above, together with the granting of facilities for improving the employees' technical knowledge, and also the arrangement of working hours so that employees at a distance could reach their work without the necessity of getting up at almost impossible hours in the morning, would mean a great deal.

An attempt to co-operate with the men in a way similar to that suggested above would go a long way to promote a better feeling than has existed in the past. The writer suggests that the opening for a conference arranged by the big engineering institutions is clearly indicated.

A. Powis Bale, A.M.I. Mech. E.

New Malden, Surrey, October 1st.

THE YELLOW RIVER BRIDGE.

Sir,—It will interest your readers to know, I am sure, that the design for the above bridge—mentioned in your issue of September 30th—which was awarded the first place by the international judges in competition with the designers of the world, was prepared by us—S. Pearson and Son (Contracting Department), Limited, of 10, Victoria-street, Westminster—and put forward by our friends and associates the Société d'Etudes et de Construction, of Brussels, and their allied Chinese companies, with which my firm is partner in this enterprise.

E. W. Moir.

Westminster, S.W. 1, October 3rd.

Institution of Gas Engineers.—The annual general meeting of the Institution of Gas Engineers will be held on Tuesday and Wednesday next, October 11th and 12th, 1921, at the Central Hall, Westminster. The following programme has been arranged. On the Tuesday morning, after the usual business, there will be a discussion of (*a*) the fifth report of the Gas Investigation Committee (Recording Gas Calorimeters); an exhibition of calorimeters has been arranged in connection with this report; (*b*) the sixth report of the Gas Investigation Committee (Blue Water Gas); and (*c*) the report of the Refractory Materials Research Committee, to be presented by Mr. A. E. Broadberry, M. Inst. C.E. In the afternoon there will be discussion of (*d*) a paper by Sir George Beilby, F.R.S., "Steaming in Vertical Gas Retorts;" (*e*) a paper by Mr. G. M. Gill on "Carbonisation in Horizontal Retorts;" and (*f*) a report of the International Commission on Illumination Conference at Paris, by the Institution's delegate, Mr. Robert Watson. In the evening, at 8.30, the President and Mrs. Goulden will hold a reception and dance at the Royal Institute of Painters in Water Colours, Piccadilly. On the Wednesday morning, at 10 a.m., there will be the annual general meeting of the Benevolent Fund, after which and the transaction of other business a paper by the Society of British Gas Industries on "Tar Distillation and Sulphate of Ammonia Manufacture" will be presented by Alderman Fred. J. West and discussed. Subsequently a report of Institution Gas Research Fellowship, "The Liberation of Nitrogen from Coal and Coke as Ammonia," jointly prepared by Mr. A. C. Monkhouse, (Gas Research Fellow), and Professor John W. Cobb, (Livesey Professor), will be read and discussed. In the afternoon, at 3 p.m., a report of the Life of Gas Meters Committee will be presented by the President and discussed, and a paper by Mr. J. G. Taplay on "The External Corrosion of Services and Mains," will also be read and discussed. On the Thursday there will be a visit to the East Greenwich works of the South Metropolitan Gas Company, and a visit to H.M. Fuel Research Station, which adjoins the South Metropolitan Gasworks.

Railway Matters.

The secretary and solicitor to the Ministry of Transport, Sir Francis Dunnell, has resigned that position as from September 30th, and returned to his former position of secretary to the North-Eastern Railway.

The Indian Railway Board has sanctioned the survey of the Agra-Ajmer-Karachi route with a view to a possible broad-gauge mail line from Karachi. The Bombay, Baroda and Central India Railway is carrying out the survey.

It may be recalled that although he retired from practice, where he was the leader of the Parliamentary Bar, in 1915, the late Mr. Balfour Browne evidently could not resist the temptation to appear before the Railway Rates Advisory Committee, when it held its first meeting in May, 1920, as representative of the Federation of British Industries.

Although the Aberdeen–Penzance through service is mainly an effort of the Eastern, North-Eastern and East Scottish groups, the Great Western provides, between Banbury and Penzance, 295¼ out of the total of 785 miles. An interesting point is that Aberdeen Joint Station is partly owned, and the first 40 miles outside that station wholly owned, by the Caledonian Company.

The Associated Society of Locomotive Engineers and Firemen has agreed to the proposals put forward at the meeting with the Scottish general managers, mentioned in this column on the 30th ult. The National Union of Railwaymen and the Railway Clerks' Association have not yet replied. The eight hours' day for enginemen is to be retained until June, 1923, but there are to be cuts of 7s. for drivers, 4s. for firemen, and 2s. for cleaners, part made on the 17th inst. and the balance on December 1st.

The London and South-Western Company adopted, some few years ago, the practice of starting its Southampton and Bournemouth trains at the even hour, and has carried this excellent feature into its suburban services. The Midland, a year or so ago, started its Manchester expresses from St. Pancras at 15 min. after the hour. The latter company, as from October 3rd, has a train to Manchester, Central, every two hours from 8.25 a.m. to 6.25 p.m., with one to Manchester, Victoria, at 1.25 p.m. These trains perform the journey in four hours.

A communication, obviously inspired, appeared in the Press recently, intimating that the Goods Managers' Conference was willing to reduce goods and mineral rates provided it could get the sanction of the General Managers' Conference. A reduction in the charges for the carriage of coal may, we have reason to believe, be expected very soon. It would be of considerable benefit to trade generally. What may, to our mind, be a difficulty in the way of any concessions in the rates for general merchandise is that the Railway Rates Advisory Committee has not yet settled the new standard classification.

The United States Transportation Act, 1920, ordered the Inter-state Commerce Commission to prepare a plan for the consolidation of the railways into a limited number of systems—originally the number was fixed at not less than twenty and not more than thirty-five, but in the Act no limit was named. The plan was then to be given a public hearing and afterwards to be adopted and published by the Commission. Two or more companies may then amalgamate if in accordance with the plan, but there is to be no compulsory amalgamation. The Commission placed the preparation of a plan in the hands of Professor W. Z. Ripley, and on the 28th ult. it was announced that nineteen systems are proposed. Notice will shortly be issued as to a public inquiry.

We mentioned in this column on the 23rd ult. that Colonel Pringle's report on the Selby collision of August 8th had been issued. His concluding observations were that there are only two positive methods of preventing an accident of that description:—(*a*) The provision of trap points, near the fouling point, on the up loop line immediately in advance of the home signal, and (*b*) the automatic application of the continuous brake at the home signal when an engine passes that signal in the "danger" position. As to (*a*) the Colonel observes that it is doubtful whether at Selby there is space available, and, furthermore, there is a bay line connection to be considered; whilst as to (*b*) he points out that control at the distant signal would not have been of any service on this occasion.

The value of the railway material exported during the eight months ended August 31st was, according to the Board of Trade returns, as follows, the corresponding figures for 1920 and 1919 being added in brackets:—Locomotives, £5,133,369 (£3,614,239, £675,403); rails, £1,929,497 (£1,586,883, £1,246,608); carriages, £1,032,593 (£1,075,731, £324,168); wagons, £3,817,023 (£3,868,603, £907,465); wheels and axles, £1,290,165 (£1,291,244, £438,246); tires and axles, £964,144 (£878,093, £638,876); chairs and metal sleepers, £859,926 (£616,784, £177,812); miscellaneous permanent way, £1,839,384 (£1,552,120, £533,106); total permanent way, £7,059,599 (£5,998,448, £1,986,414). The weight of the rails exported was 87,748 tons (82,477 tons, 77,694 tons), and of the chairs and metal sleepers 35,236 tons (28,548 tons, 10,870 tons). Rails to the value of £25,276 went to New Zealand.

The worst "running-down" case of platelayers within our memory occurred at Stapleton-road, Bristol, Great Western Railway, on the 26th ult., when six men were killed. The previous worst case was four killed at Camlachie Junction, North British Railway, on November 11th, 1911. In the present case, eight men and a ganger were working on the down South Wales line, and stood back to allow a goods train to pass. In doing so, they stepped foul of the up Clifton Down line, and were caught by a passenger train from Avonmouth. One man jumped clear; five, including the ganger, were killed outright; and three were injured, of whom one died. From the verdict given by the jury, it would seem that the ganger failed to appoint a "look-out" man, but the men also broke Rule 273 (*a*), which says that "they must at once move clear of all lines unless they can distinctly see that they are in a position of safety and in no danger from another train approaching them unobserved."

Notes and Memoranda.

The Swedish Ironmasters' Association reports that the fuel supply in Sweden at present is very good, especially coal, and that, owing to industrial depression, no difficulty need be feared regarding meeting the demand. There is therefore no necessity to maintain the prohibition of export of coal from Sweden.

For the purpose of providing a supply of fresh water, a sugar refining company with works in San Francisco Bay employs a barge capable of holding 500,000 gallons. She is 204ft. in length, 52ft. beam, and draws 12½ft. Her load is acquired either by opening sea cocks when she goes up-river for a load, or through wharf connections, as at San Quentin, where a 9in. main brings water from Mt. Tamalpais.

The output of pig iron in Canada during the first six months of 1921 totalled 309,206 long tons, as compared with 449,810 long tons in the corresponding period of 1920. The bulk of the output was basic iron, about one-fifth of the total being foundry iron and a small percentage malleable iron. The production of steel ingots and castings in the half-year ended June 30th, 1921, was 259,000 tons, against 547,000 tons for the first half-year of 1920.

In the official report on an explosion which occurred in the pelletting house of a gunpowder factory at Glyn Neath, Glamorgan, it is recommended that all powder dust lying on these machines should be thoroughly wetted with water before they are started up. The probable cause of the explosion was the irregular movement of the hydraulic ram, on account of air being entrapped in the water pipes, with the result that the two pressing plates came together more or less violently.

In view of the frequency with which fires occur on board ship, and in order to meet the need felt by shipowners, shipbuilders and masters for a comprehensive statement of the recommendations and requirements of the Board of Trade as to the means of dealing with such outbreaks, a revised circular, embodying the recommendations made by advisory committees with regard to fire extinction and the definite instructions which the Board of Trade has issued to its surveyors on the subject, has been issued.

In the case of passenger steamships fitted for oil fuel, the Board of Trade definitely requires that besides the usual water service and hose pipe connections, steam from the boilers is to be led to pipes perforated for the emission of steam into the lower parts of the boiler-room. The control of this steam supply is to be outside the boiler-room. In each stokehold there is to be provided a receptacle holding about 10 cubic feet of sand, sawdust impregnated with bicarbonate of soda, or other approved dry material suitable for extinguishing fire. Suitable scoops for distributing the sand, sawdust or other material are to be provided, and also a chemical fluid extinguisher of approved type for use in any specially confined or dangerous space.

The phosphorus content of an iron ore, states Mr. R. M. Winslow in the September issue of the *Journal* of the Franklin Institute, is a determining factor as regards the value of an ore and its metallurgical treatment. The obvious advantages that would pertain to a cheap method for removing phosphorus by leaching has led the American Bureau of Mines to make some laboratory tests to determine whether it is economically possible to reduce the phosphorus content appreciably by leaching. Sulphuric acid proved the best solvent, but the highest extractions were negligible from a commercial standpoint. The conclusion is that the method is not commercially feasible. Further details will be found in a short paper recently published by the Bureau.

In a paper on "Turbine Reduction Gears *versus* Electric Propulsion for Ships," published in the *Journal* of the American Institute of Electrical Engineers, Mr. Eskil Berg states that in every case, with the exception of destroyers and light scout cruisers, he has found that in order to be able to use single-reduction gears, the turbine speeds have to be made too low to produce the best results, and also that a propeller speed has to be chosen which is too high for good performance. A compromise is therefore always necessary, and the net result is an economy less than that obtainable with either double reduction gears or electric drive. A table given in the paper shows that even double-reduction gears of the types now used necessitate turbine speeds which are lower than those needed for the best results.

At the second session of the Oil Conference in connection with the International Shipping, Engineering and Machinery Exhibition, held at Olympia, Mr. James Richardson, speaking on "The Progress of the Motor Ship," said that motor ships were making a very powerful bid for freight-carrying now in the mercantile marine. Well over 10 per cent. of all the tonnage now under construction and going forward was to be engined with Diesel engines, and in numbers of ships—since oil engines were unsuited as yet for the higher powers—the percentage would be higher, probably 15 per cent. Though oil engines cost substantially more than steam plants, the saving in operating costs was so great that the extra initial capital expenditure was rapidly written off. Moreover, a hull fitted with oil engines would carry more cargo than a steamer, due principally to the saving of the bunkers.

The steady silting up, not only of the harbour of Macao, China, and the neighbouring channels, but of the whole sea bed of the district, has robbed that port of the advantages of its geographical position. The real mouth of the West River becomes yearly more plainly the channels which flow south-eastward from Samshui and Kongmoon and are as accessible from Hong-Kong as they are from Macao. Harbour improvement works on a large scale have been commenced during the year, to regain this distributing trade and to encourage direct shipping with abroad. The work, which is to cost some 10,000,000 dols., embraces a breakwater to enclose a new harbour accommodating vessels drawing up to 22ft., an inner harbour, near Green Island, for native craft and shipbuilding slips, and spacious wharves, piers, and godowns. The breakwater and sea walls are expected to be finished within three and a-half years, and the whole scheme completed in eight years.

Miscellanea.

A commission of Argentine and Brazilian engineers has completed its investigations relating to the Iguazú falls, and has reported to the Ministry of Public Works that the possibility exists of obtaining from them an immense amount of hydro-electric power.

According to an announcement by the vice-president of the Winnipeg Railway Company, a new electric power development plant, which will have a capacity of 18,000 horse-power and which will cost about 10,000,000 dollars, is to be erected at Great Falls, on the Winnipeg River, 63 miles from Winnipeg.

It is reported by the Director of the Federal Bureau of Commerce and Industry, that seventy-five British manufacturing firms have already established solid interests in industrial works and factories throughout Australia, and many more are preparing similar enterprises, notably in Tasmania and Western Australia.

We are informed that the Committee of the Newcomen Society for the Study of the History of Engineering and Technology is engaged in drafting the constitution and rules for the due management of the affairs of the Society. They will be circulated prior to a special general meeting, which will be called to discuss them. The annual general meeting for the election of a new governing body will follow. Until then, the present Committee will continue to act.

Commenting on the formation at Hamburg of a new German-Scandinavian shipping company, the *Christiania Handelstidende* says the Germans are to-day the only nation in the world that can keep their shipping going. The reason for this is the German currency's low exchange, and the facts that German labour is not only cheap but also efficient, that German ships are supplied with cheap bunker coal, and that they are granted numerous privileges in competition with other nations.

The Robert Bosch Magneto Company, Incorporated, has just been incorporated under the laws of the State of New York, with a capital of 250,000 dollars. Mr. Otto Heins, who was president of the Bosch Magneto Company before the war, is president of the new corporation. The company claims to have a new Bosch invention for use in the cheaper class of motor cars—a combination battery and magneto system. It will also offer a new Bosch electrical lighting system for high-priced cars.

The famous chemist, M. Georges Claude, in an interview with the *Matin*, said: "It seems to me that the explosion at Oppau is a terrible lesson for the partisans of huge factories where the enormous quantity of manufactured products constitutes a permanent danger, not only for the workshops and thousands of workers, but also for the neighbouring districts. The recent disaster is a condemnation of such works and a confirmation of the thesis I have always maintained—that a hundred small centres are better than one enormous centre."

That there have been great developments in the use of electrical energy for purposes of lighting, power and traction in Liverpool is shown by the fact that forty years ago Liverpool's electrical outfit consisted of one small portable 10 horse-power engine, whereas to-day the city possesses plant with a capacity of close upon 100,000 horse-power. On July 19th, 1921, a new turbo-alternator at the Lister-drive power station, installed by the Metropolitan-Vickers Electrical Company, Limited, was set in motion by the wife of Mr. Frank C. Wilson, the chairman of the Committee. The machine in question is unique, because it is the largest machine in the world running at 3000 revolutions per minute. It has a normal output of 12,500 kilowatts, but is capable of developing 15,628 if necessary.

We hear that a large wireless telegraph station is being erected near Moscow, the purpose of the Russian People's Commissariat of Posts and Telegraphs being to install apparatus that will enable Moscow to speak simultaneously to every place on the face of the earth. The apparatus is being made in the big radio laboratory and works at Nijni-Novgorod, under the supervision of a band of Russian scientists. During Russia's recent years of isolation, her radio progress has been remarkable. Most of the experts are not Bolsheviks, but are enthusiasts for research and eager to develop the possibilities of wireless. Russia is covered by an efficient network of 597 wireless stations—about six times as many as in the British Isles—which keep Moscow in instantaneous touch with what is going on all over the country and in Siberia and Turkestan.

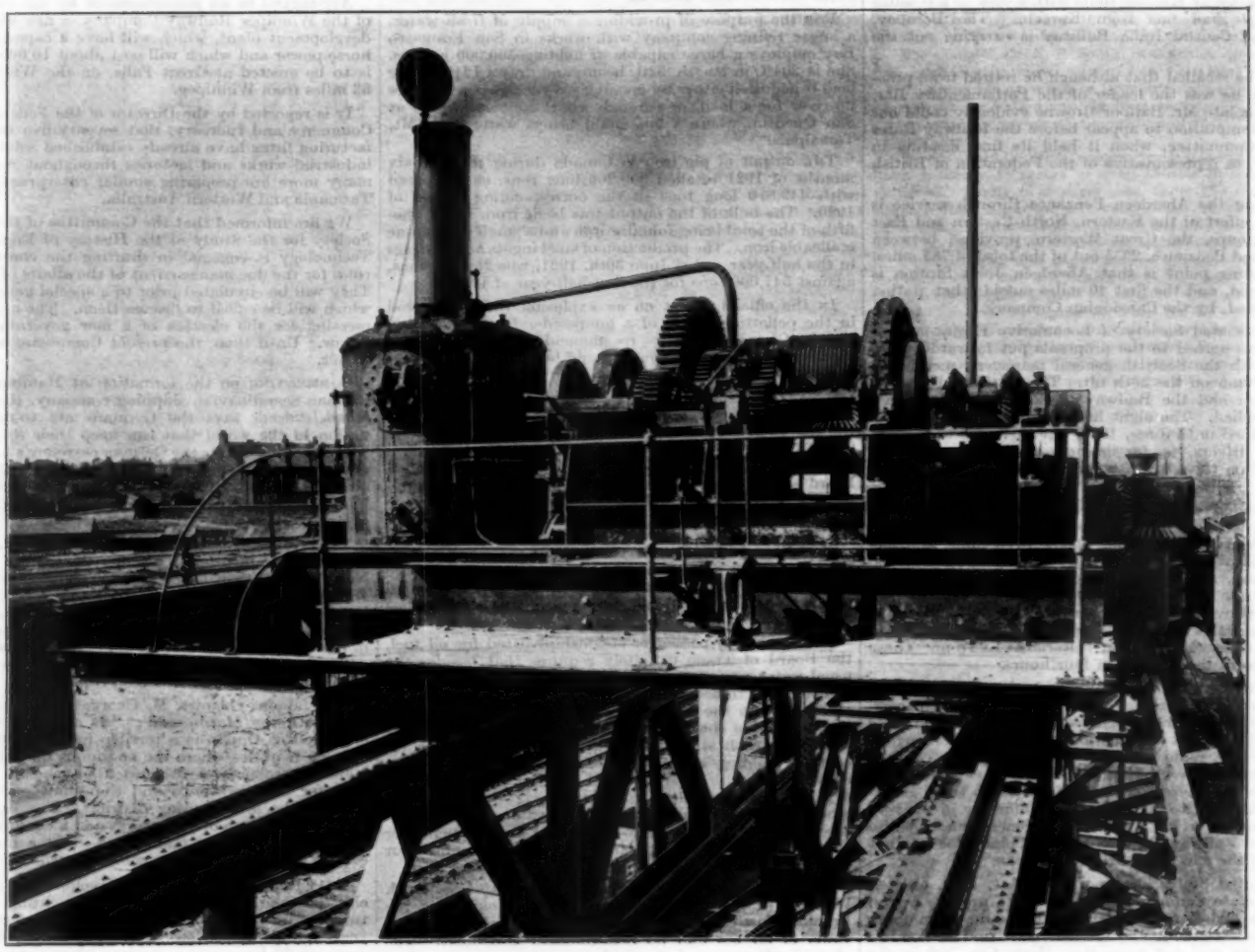
In its mission for the improvement of the relations between employers and employed, the Industrial League and Council (of which Viscount Burnham and Mr. G. H. Roberts are presidents) has held numerous week-end conferences for the discussion of economic problems. These conferences are held under unusual conditions, but greater beneficial results are believed to have resulted than would have been the case if proceedings had been more formal. Each conference has taken the form of a house party to which a friend of the League, acting as host, invites for a full week-end representative employers and trade union officials, approximately in equal numbers, for the free and candid expression of views on a subject of interest to the industrial world. The latest entertainers of the League were Mr. H. V. Roe, the pioneer in aviation, and his wife, Dr. Marie Stopes.

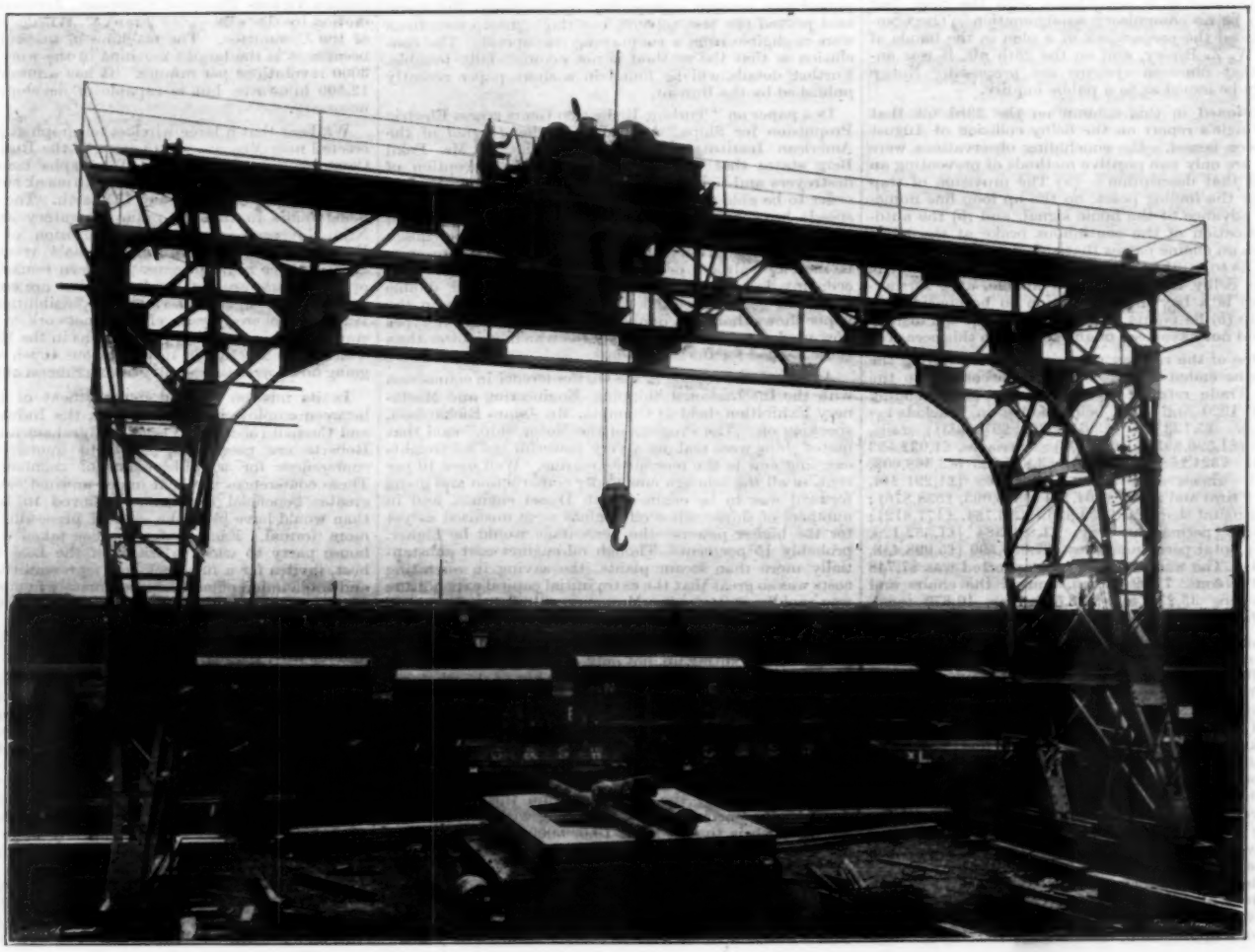
The correspondent of the *Deutsche Allgemeine Zeitung* at Ludwigshafen writes that as a result of the investigation which has been carried out, it has been ascertained that the Oppau catastrophe was due to the explosion of a store of about 4500 tons of a compound of ammonium sulphate and ammonium nitrate known as Ammonsulphatsalpeter. This compound had hitherto been considered absolutely free from any danger of explosion, and for years past, when removing it from warehouses, explosives had been used to break up any large hard blocks which might have formed without any suspicious phenomena having been observed. Ammonium nitrate and ammonium sulphate, say the experts, may form a double salt, $2NH_4NO_3(NH_4)2SO_4$, which contains 54.8 parts of ammonium nitrate and 45.2 of ammonium sulphate, but this double salt was also considered to be non-explosive.

TWENTY-TON STEAM GOLIATH CRANE

BUTTERS BROTHERS AND CO., GLASGOW, ENGINEERS

(*For description see page* 381)





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By arrangement with Reuter's Engineering Service, **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

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THE ENGINEER.

OCTOBER 7, 1921.

Thrust Meters in Marine Work.

On account of the practical difficulties involved, actual measurements of thrust in a ship's shafting were confined to attempts on a very small scale until quite recently, and the later successful instances do not seem to have received the attention which they merit. Both Messrs. Cammell Laird and Co. and Messrs. Denny had conducted a few trials of this nature, and in 1908 the Vulcan Company, of Stettin, had succeeded in measuring the thrusts of the turbine-driven light cruiser Stettin, of 22,000 shaft horse-power, but nothing of a really satisfactory nature had been accomplished prior to the trials of H.M.S. Mackay, a large destroyer flotilla leader of 1800 tons and 44,000 shaft horse-power, which was completed at Birkenhead in 1919. Full details of the thrust meter employed and of the trials were published in The Engineer of August 29th, 1919, and an analysis of the latter was given in a paper by Mr. Holt to the Institution of Naval Architects in 1920. The extremely interesting results obtained merit careful attention on account of their unique nature and the valuable deductions which can be drawn from them. The thrust meter used was of a type evolved by Messrs. Cammell Laird and Co. after many experiments with other designs, and consisted essentially of a series of 3½in. oil cylinders incorporated in the casing of the Michell thrust block, arranged with their axes concentric with the shaft, and with their pistons in contact with the abutment ring carrying the bearing pads. The product of the oil pressure and the areas of the cylinders sufficed to measure the thrust, which on many occasions ran up to a figure of about 60 tons on each shaft.

The results obtained in H.M.S. Mackay might reasonably be regarded, not with suspicion—though as being at least unconfirmed were it not for the we should like corroboration of certain points—but fact that shortly afterwards the Bath Iron Works, Maine, U.S.A., used a thrust meter of different design in the United States destroyer Pruitt, which they had constructed, and whose trials took place in September, 1920. A very full description of both vessel and trials appeared in the *Journal* of the American Society of Naval Engineers in February last. The thrust meter used in the Pruitt consisted of an attachment to the Kingsbury—which is the American form of the Michell—thrust block, which was fitted to the forward end of the gear wheel shaft. In principle, it consisted of a thin flexible copper disc, about 22in. in diameter, placed in a closed chamber at the end of the shaft, from which it was separated by a film of oil, and operated by oil pressure on the face of the disc remote from the shaft. This thrust meter arrangement is not unlike the footstep bearing used in vertical turbines, whether steam or water-driven, where the weight of turbine, shaft and generator, often running into large figures, is supported on a film of oil. The U.S.S. Pruitt is a vessel of about the same speed as the Mackay—35 knots—but slightly smaller, being 1200 tons displacement, and having about 27,000 shaft horse-power. A very full analysis of the trials was made by Mr. J. Burkhardt, of the Bath Iron Works, which enabled an interesting comparison to be made with those of the Mackay. It is not our intention to elaborate the individual performances, but to call attention to the fact that in both cases the operation of these meters enabled a measurement of thrust over a range of speed to be obtained, which, by its ease of application and reliability of measurement, offers a method of solution of many problems connected with both resistance and propulsion which for lack of such apparatus have hitherto defied precise analysis. Even in their apparently considerable divergence of results—for the individual analyses of Messrs. Holt and Burkhardt are susceptible of considerable expansion and detailed comparison—the two performances corroborate one another to a very marked extent, and the broad facts which ensue from their evaluation undoubtedly contribute no small measure of mutual support to a comparison from which much is to be learnt. Without entering into details, we may note that the measurement of thrust in these cases, as in that of the Stettin, cast considerable light on questions of actual wake and hull efficiency values, on propeller performance, and on the differences between the estimated resistance of the ship from tank experiments and that actually measured. Reliable thrust meter readings put an entirely different complexion on the value of experimental data, confirming it or modifying it, as the case may be. Whether cavitation is present or not, thrust meters show precisely what the propeller is doing, and by deduction from the effective horse-power of the model enable the uncertain influences of air or appendage resistance to be assessed. When cavitation is present—and it is probably far more prevalent than is generally imagined—it is very difficult, if not impossible, to make any accurate calculations of the thrust horse-power delivered by the screws, and even when it is not regarded as affecting results there are frequently discrepancies in propeller performance, calculated from the results of trials of models, which the use of a thrust meter largely discounts. The measured thrust per square inch of projected area of screws ran up to 15.7 lb. per square inch in the Pruitt and to just 15.0 lb. in the case of the Mackay, figures which are considerably on the high side, according to some authorities. But though the Mackay's propellers (on the deep load trial) were obviously breaking down, the Pruitt's were still continuing to work with high efficiency. Calculated from the effective horse-power of the model with appendages, the respective pressures were 14.8 lb. and 12.5 lb. This is but a small instance of the light shed on some unsolved propeller problems by this measurement; the values of hull efficiency and wake factor obtained by these measurements were distinctly different from those which might have been (and without adequate basis) anticipated from other trials. Thrust measurements will not solve the problem of the propeller efficiency of the ship, but they remove a most important element of doubt regarding its performance; the determination of the wake factor in the ship, as distinct from the amount found by experiment in the tank, is still essential before the real slip, and hence the efficiency, can be accurately estimated. But the evaluation of this, as shown by Mr. Holt, can be more readily approximated when the true thrust is known. For the determination of the effect of various conditions of bottom, which is so necessary before full-scale proof of the laws of surface friction can be obtained, thrust meter trials offer a prompt and reliable solution. It would not be surprising to learn that experiments of this nature have already been conducted, and whether the advantage to the profession as a whole or the commercial value of the knowledge thus acquired will affect their publication remains to be seen. It would seem that this is information which might properly be obtained by experiments in naval ships. It is, however, a subject which is really of greater importance to the mercantile marine, where the fact is gradually being appreciated that the saving of one effective horse-power means, roughly, two of shaft horse-power.

But it is mainly in the facilities which it affords for the comparison of experimental data with observations in practice that the value of the thrust meter will be found. It possesses the paramount advantage of giving the actual resistance of the whole ship under any condition or combination of conditions of loading, trim, weather, state of sea, depth of water, or condition of bottom; quite apart from the comparative data to be gained regarding the differences

between trial and service performance, such matters as astern performance or manœuvring data (one engine ahead and the other astern) can be elucidated, while the use of actual screws to corroborate model results for purposes of design can now be placed on a very definite footing. In these items there is scope for a deal of research and profitable development of knowledge.

Of Muddling Through.

One of these days, when the laws of economics are familiar commonplaces of science like the laws of falling bodies, "muddling through" will be acclaimed a virtue instead of, as now, a vice. For in science virtues are those things that succeed and vices those things that fail, and grievous as it is to an orderly mind, it must be admitted that that method of operating which is known as "muddling through" has been as successful—in the hands of Englishmen—as anyone has any right to expect. Indeed, the very name is a spiteful or piqued admission that the plan does succeed, that it does get through, that it does over and over again defeat the precise plans of the well-ordered minds of opponents. We have always, so say the historians, muddled through our wars, and yet with few exceptions we have won them; we have always muddled through our political and economical problems, and still, somehow or other, we have consistently come out of them no worse off, certainly, and sometimes much better off than other nations which have worked "according to plan." For years and years our industries were, in the eyes of tidy critics, "muddled through;" we had little works with little employers; our commercial arrangements abroad were scrappy and inefficient; our means of transport were confused, competitive, and expensive; our works management was conducted without clocking-in and clocking-out, without schedules, card indexes, and all the paraphernalia and mechanism of really intelligent organisation; our letters were sometimes not copied, often not answered, generally not filed; and so on with a long list of offences of omission and commission. And yet we built up a magnificent home trade and a foreign trade that was the envy of competitors; we advanced science in all directions; we bred famous philosophers, great engineers, eminent architects, prosperous traders; our Armies were successful on land and our Navy was unassailable at sea. But above all London was the financial mart of the world and the golden sovereign and British credit formed the twin rock on which a stable international currency was founded.

Cynical people say we succeeded despite ourselves. But that is only equivalent to an admission that they do not know why we succeeded. Looked at in that light, the old steel makers of Sheffield, who hardened swords and cutlery to the envy of the world, only "muddled through," for they knew nothing of the modern science of heat treatment, and their only pyrometer was the eyes Nature had given them or a twig of willow. They did not know the laws, yet they obeyed them, and that, after all, is what really matters. In time we shall formulate those laws, and in that day we shall see that, all unconsciously, Britain was obeying them whilst she was muddling through, and we shall know why she succeeded whilst others who had set up for themselves gods in filing cabinets were failing. What those laws will turn out to be we do not attempt to prophesy, but we suspect that "the modulus of economic flexibility" will come into them somewhere. It cannot be denied that there was far greater flexibility in the engineering industries of fifty years ago than there is to-day. Demarcation disputes between trades unions were almost unknown; men might work for what they could earn; the works manager knew the crafts of all the shops under him and was on direct friendly terms with all the foremen and most of the workpeople. The employer himself would take his coat off and chip and file with the best in an emergency. There were always workmen about—jacks-of-all-trades, if you will—who could do, and do well, anything that had to be done. There was no "departmentalisation," there was relatively little precise specification of duties. Out in the markets there was the same flexibility, the same adaptability. If a firm got an order for a score of engines or machines or a few gross of pots and pans it was content, and in consequence it did not mind changing the design to suit its customers' requirements. The owner was not infrequently the firm's traveller; he could make what terms he liked and make them quickly, for no shareholders would drop upon him at the annual meeting. If he had money to spare he enlarged his works without the interference of local building by-laws, or spent it on fitting out an engine for a show or on experimentation and research. If he had not money to spare or did not want more, he just went on in his humdrum way making sufficient for his needs and coming to an end when a more enterprising competitor robbed him of his clients. All through the whole gamut of business there was plenty of flexibility, plenty of scope for the development of the personality of every person engaged in it. That is, we suggest, one of the reasons why we "muddled through," why we did not muddle up to a brick wall and break our heads against it. Everyone knows that there is nothing like the same flexibility in modern industries, and there is arising a feeling that we must try to get it back again. Your modern highly scheduled and be-indexed business is as hard as glass and as brittle. As long as its environment retains the characteristics which it was pre-ordained to meet all goes well; but if there is a hitch anywhere the whole concern is disorganised. The motor car industry would be thrown into a state of total collapse by the failure of the supply of ignition plugs even more certainly than the ship-building industry was damaged by the strike of the ship joiners. It is demarcation disputes as much as anything else that have led to the threatened closing of Yarrows in a few weeks time. We must not blame the men wholly. They have caught the spirit of the times. When they see every section of industry cut up into water-tight compartments is it not natural that they should follow suit? Demarcation suits managers very well up to a point. The men have carried the system too far; that is all.

It is, obviously, impossible to return to the old methods. We are not an isolated State like Butler's Erewhon. We cannot jettison all the advances of the last fifty years and return to a simpler condition. No one in his heart of hearts wants to do so; but there is an increasing body of men who rebel against the inhumanity of system carried to excess and of men who hold that system is doomed to collapse under its own weight. They want order in industry, but they want also greater flexibility, greater power of self-expression than is possible under a perfectly scheduled organisation. The complaint of the men in the great industrial combination, which are as common in this country to-day as in America, is that they are no more than units in a system; we know many that have left such combinations voluntarily and joined, instead, smaller firms where their personality may have freer play. They want to do what the systematist would call "muddling through," because there is more live human interest in it. In trades union circles the same feeling is spreading. The vast amalgamation of big unions is not an unqualified success. It is impossible for a small body of officers to handle a great number of men without very detailed organisation, and that organisation takes a deal of humanity out of the business. Hence we find in such bodies single men and little groups trying to assert themselves against their councils and managers. In every big agglomeration of men the same thing occurs. In military armies it can be kept in check by rigid discipline; but in industrial armies discipline cannot be enforced, and sooner or later there is an outbreak. These things are worth considering. One of the objects—not expressed perhaps—of welfare work is to counteract the inhuman effects of large organisations, but it succeeds only partially. Something better is wanted. We need the liberty of "muddling through" with the efficiency of system. Is it attainable?

The Electrification of the Swiss Federal Railways.

No. II.*

Arrangements for Energy Distribution Sub-stations.

With regard to the overhead conductors, the drawbacks connected with the three-phase system have already been mentioned; while between the other two systems constructional differences are not great. The third-rail conductor is out of the question for Swiss conditions. Differences occur, however, in the equipments required for transmitting the energy from the generating stations to the feeding points, due, on the one hand, to the magnitude of the pressure in the overhead conductor, and, on the other hand, to the system employed. Concerning the pressure, the higher it is chosen to be, the greater the distance between feeding points—theoretically, the distance increases as the square of the pressure. With 3000 volts continuous pressure and 15,000 volts single-phase pressure and a single train on the section, the distances would be theoretically in the ratio 9 : 225. Taking into account the impedance of the conductors and the skin effect of the rails, this ratio is reduced to about 1 : 10 for single-phase current at 15 cycles, assuming a copper cross section of 200 square millimetres in each case. Local and load conditions naturally impose other limitations. Further, it has to be remembered that the greater the area of distribution, the more favourable will be the relation between momentary, maximum peak loads and the average mean load. The smaller this ratio, the lower will be the installation costs of generating stations, transmission lines, feeders or sub-stations.

If the power station is not situated so that the overhead conductor can be connected direct thereto, sub-stations become necessary. Further, such a sub-station is needed at every point where the energy is converted into the form required by the overhead system. In these sub-stations are either stationary transformers for transforming the pressure, or rotating machines for converting the current from one form into another, as *e.g.*, from three-phase into continuous current. These sub-stations, particularly where the current has to be changed from one form into another, necessitate considerable outlay in construction and in working, and increase the cost of energy, whether obtained from railway or from other generating stations. Moreover, they are also a source of loss of energy. As an illustration of the effect of such sub-stations on the energy supply of a large railway project, it may be mentioned what would have been involved on the Lötschberg Railway had a continuous pressure of 3000 volts been chosen instead of a single-phase pressure at 15,000 volts. At present, the central station at Kandergrund feeds the whole line direct—without sub-stations—at 15,000 volts. Had continuous current been used, four 5000-kilowatt sub-stations would have been needed, and they would have cost about three million francs, a sum much in excess of the two million francs required for the whole overhead construction. Working costs, maintenance, interest and redemption of the sub-stations taken at 10 per cent. and energy loss at 30 per cent., would have increased the cost of energy about 400,000f. per annum, or to more than twice the present cost. Though the locomotive equipment might have been somewhat less with continuous current, the saving would have been negligible, since the total cost of the single-phase locomotives was not as great as the cost of the sub-stations alone would have been. Similar comparative figures would be given by other projects, though they would not necessarily be so pronounced as those for the Lötschberg line.

Sub-stations for converting the current system also occur with the single-phase system when the energy is not generated in the required form. This is the case on the Engadine line and the Wiesental Railway, which receive three-phase supply from Brusio and Augst-Wyhlen respectively.

With continuous current, conversion must be reckoned with, because transmission at an economic pressure is not possible, nor is it possible to generate power at every feeding point. For conversion, moving machinery is generally needed, though recently the mercury rectifier—a type of laboratory apparatus—has been proposed for converting alternating into continuous current. It is not known how far such rectifiers, assuming they could be made suitable for traction on railways, would affect the cost of sub-stations; but the difference cannot be great, since buildings, transformers, and particularly the costly switchgear, would not be affected thereby. Further, from the amount of auxiliary apparatus—ignition, vacuum pump, water cooler, &c.—rectifiers would apparently require delicate handling. On the other hand, with rectifiers a higher electrical efficiency is obtainable, and thus a reduction in the conversion costs, but the economic superiority still lies with a system, like the single-phase system, in which no conversion is required. The fewer the sub-stations in a large railway network, the lower will be the distribution charges.

Power Stations.

Owing to the great load fluctuations, railway service is not an agreeable form of load for the generating station. Even for fairly large networks, a variation of 1 : 4 between the mean and peak loads must be assumed. These fluctuations must be taken by the generating station, because it is usually there that the load can be equalised in the most economical manner, as was observed in several examples which have been investigated by the Commission. Further, the amounts of energy to be dealt with are considerable—the mean loads alone varying from 10,000 to 20,000 horse-power. It is obvious that for such supply, generating stations—whether hydraulic or steam—must be specially designed. Existing stations, for lighting and power supply, are not suitably equipped, nor have they the necessary power available. Consequently, for supplying the Swiss main lines new works which can be enlarged as required will mostly be needed.

Separate feeders for the railways are essential—whether the energy has to be converted or not—in order to obtain the greatest security of supply. The same is true of the generators, even when the current taken by the railways is of the same kind as that supplied for power and lighting, the magnitude and fluctuations of the traction load will entail special units being employed for this service. Even the mercury rectifier would not simplify matters. On the contrary, the distortion of the pressure and current curves alone might entail separate generators. Where, therefore, an electricity supply company

* No. I. appeared September 30th.

intends to furnish energy in bulk to the railways, it will be necessary to install special machines, the type of which must be such that the cost of production for the railway will be a minimum, even when the railway system is different from that of the other services supplied by the station.

That the main-line railways can draw their requirements from a common network linking up all possible sources distributed throughout the country is considered to be quite out of the question. For the security of the railway service, there must be a careful arrangement and division of power lines and machines, which can best be carried out in separate large power stations.

This leads to the further consideration that the supply of energy for the railways, wherever possible, should be independent of the supplies for power and lighting; and that it would be quite wrong to give preference to any particular system simply because power for that system could be converted more readily from some other system not needed by the railways, such as would be the case if one were compelled to produce continuous current for the railways from three-phase current.

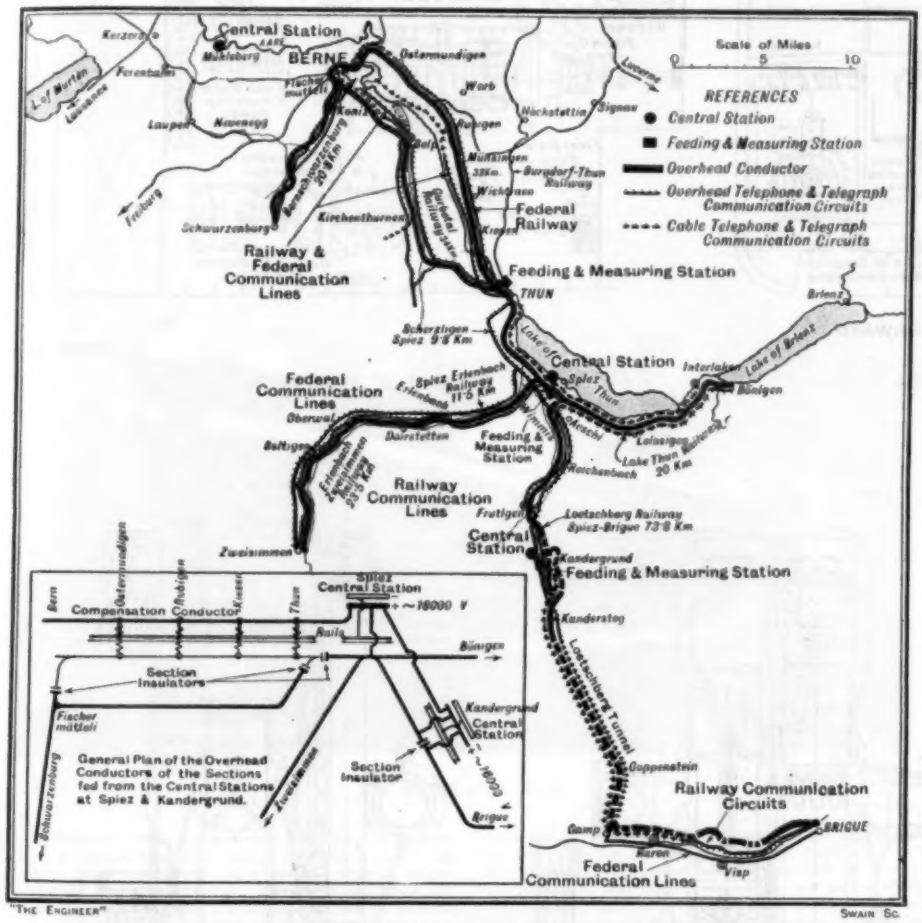
Finally, from a military standpoint, it is best to have as few sub-stations as possible. It cannot be denied that in case of invasion electric traction is more sensitive to disturbance than steam traction. The danger does not lie so much in the possible damage to conductors, since such damage can be repaired in a very short time, as in the destruction caused by bombs dropped on to central or sub-stations, which may cause damage that it would take weeks or months to repair. Here, again, the single-phase system is the best, as needing fewest sub-stations. But in any case it will be necessary to provide protection against the activities of aircraft when designing future generating stations for railway supply.

Comparison between Electric and Steam Traction.

Electric traction possesses several technical advantages, which, however, are revealed only from their economic effects—it is, indeed, rather the total economic result that is important and not individual technical superiority, for no one will contend that steam traction has not attained to a high degree of perfection. The speed question is of particular interest, not because excessive velocities of over 200 kiloms. per hour—as in the Berlin–Zossen trials—can be obtained with electric traction, but because the latter permits an increase in speed with heavy loads on gradients, which at present is rather low on account of boiler limitations. For example, on the Lötschberg Railway a 300-ton train is hauled at 50 kiloms. per hour on a gradient of 27 in 1000. The electric locomotive to which the 300-ton load is coupled weighs 104 tons. To do the same work for one hour with steam would need three locomotives, weighing together 350 tons. If the same conditions had been taken for the Lötschberg line as obtain on the St. Gothard, namely, 40 kiloms. per hour for fast trains and 20 kiloms. for goods, then two such locomotives could have done the work. Speed does not matter so much so long as the line is not fully utilised, but makes itself felt as soon as the capacity of the line becomes too small for the traffic to be carried. The necessity then arises, either to double the track or to electrify. A comparison is made between the actual costs on the Lötschberg for 1914 and the estimated costs with a steam service similar to that on the St. Gothard line. Owing to the smaller locomotives, it is assumed that the locomotive power with steam would have to be 50 per cent. greater than that with electric propulsion. The cost of the larger number of steam locomotives would be nearly equal to the cost of the electric locomotives.

	Electric. Francs.	Steam. Francs.
Power or coal	350,000 ..	875,000
Locomotive *personnel*	180,000 ..	270,000
Locomotive upkeep	110,000 ..	160,000
Overhead line charges	194,000 ..	—
Total costs	834,000 ..	1,305,000

Thus there is a difference of 471,000f. in favour of electric traction.



MAP SHOWING SWISS RAILWAYS WORKING WITH SINGLE-PHASE 15,000 VOLT CURRENT

The results of the paper are briefly recapitulated as follows:—

(1) There are three systems which can be adopted with complete safety in the electrification of main-line railways.

(2) The three-phase system is the least suitable. The 15,000-volt single-phase system both fulfils all technical requirements and has been tried in Switzerland. Further, it promises the best economic results. The last two claims cannot be made for the continuous current system.

(3) Unless it is decided to postpone the electrification of the Federal Railways for several years, the decision in favour of single-phase can be made now with complete safety and justification. Nothing better can ever be expected from continuous current, but only as good when it becomes possible to work at pressures of about 12,000 to 15,000 volts—a matter still a long way off.

Recent Observations by Herr L. Thormann.

The following reply was received from Herr L. Thormann, the author of the above paper, and chief engineer of the Lötschberg Railway, in January of this year, in response to the question whether his opinion concerning the suitability of the single-phase system for main-line traction was still the same as expressed in his paper of December, 1915:—

Herr Thormann stated that in the further developments of main-line traction nothing had occurred to change his views in any way. The experience gained in the recent extensions on the Bernese Alpine Company's lines had also been satisfactory in every way. The insulation difficulties which occurred originally in the overhead systems and in the locomotive transformers had been completely overcome. The working of the locomotives, especially of the latest type, could, he added, be said to be faultless, both from an electrical and from a mechanical standpoint.

Recent Extensions of Electrification of the Bernese Railways.

The adjoined plan shows the lines which are now supplied with single-phase current at 15,000 volts and 15 cycles from the Bernese central stations at Spiez and Kandergrund. In addition to the original line Thun–Spiez–Frutigen–Brigue of the Bernese Alpine Company, the section Berne–Münsingen–Thun of the Federal Railways was electrified in 1919 while in 1920 various lines belonging to the Bernese Alpine Railway were converted for electric traction, making altogether a total electrified length of 220 kiloms. It is shown on the map how the different sections are fed from the hydro-electric stations at Spiez and Kandergrund. With the exception of the section Berne–Thun of the Federal Railways, all the lines are connected direct to the 16,000-volt single-phase generators. For the Berne–Thun section, auto-transformers have been installed experimentally in order to compensate the currents in the overhead lines with respect to the neighbouring communication circuits.

The main line Berne–Münsingen–Thun–Spiez–Brigue is generally worked with the original 2600 horse-power Lötschberg locomotives, and occasionally with the new St. Gothard locomotives. On the remaining sections, new 1 B B 1 locomotives, capable of exerting a draw-bar pull of 8000 kilos. at 35 kiloms. per hour, are employed.

Interference with Communication Circuits.

With reference to the effects of the power currents on the telephone and telegraph circuits, it can be stated that unpleasant experience in this respect no longer exists. The positions of the railway communication circuits and of the Federal trunk telephone lines are shown on the plan. These lines, which originally ran alongside the railway, have been removed. The railway circuits have been partly relaid in lead-covered cables along the track, and partly erected on poles 10 m. to 500 m. away from the railway. The Federal authorities have likewise decided to use to some extent underground cables, partly along roads and partly along the track. Where overhead circuits have been retained, they are kept as far away from the track as possible—usually 0.5 kilom. to 1 kilom. On the Federal section Berne–Thun the railway communication circuits along the railway have been allowed to remain at distances of only 3 m. to 6 m. away from the high-tension lines. The compensation of the three-wire arrangement and the negative boosting action of the auto-transformers have proved perfectly satisfactory in working. It is clear that the devices just described have solved the question for these Bernese lines in a relatively simple manner and at small cost. Since the construction of the overhead conductor in general makes it imperative to remove the communication circuits, because the space is required for the conductors, the removal is an expense that has to be incurred with any system and not merely with the single-phase.

Arrangement of Feeders.

The plan also shows that the feeders from the power stations to the trains are made with the minimum equipment. In this respect the economy of the single-phase system cannot be approached by any other system working at a lower voltage. If, for example, 3000 volts continuous current had been used, a number of sub-stations—say, at Berne, Thun, Zweisimmen, Gampel and Brigue—would have been necessary, in additon to three-phase lines from the power to the sub-stations. The extra cost of the lines thus incurred can be estimated at 50 per cent. of the actual single-phase lines. At 1500 volts continuous current, the economy of the one-phase system would be still more pronounced.

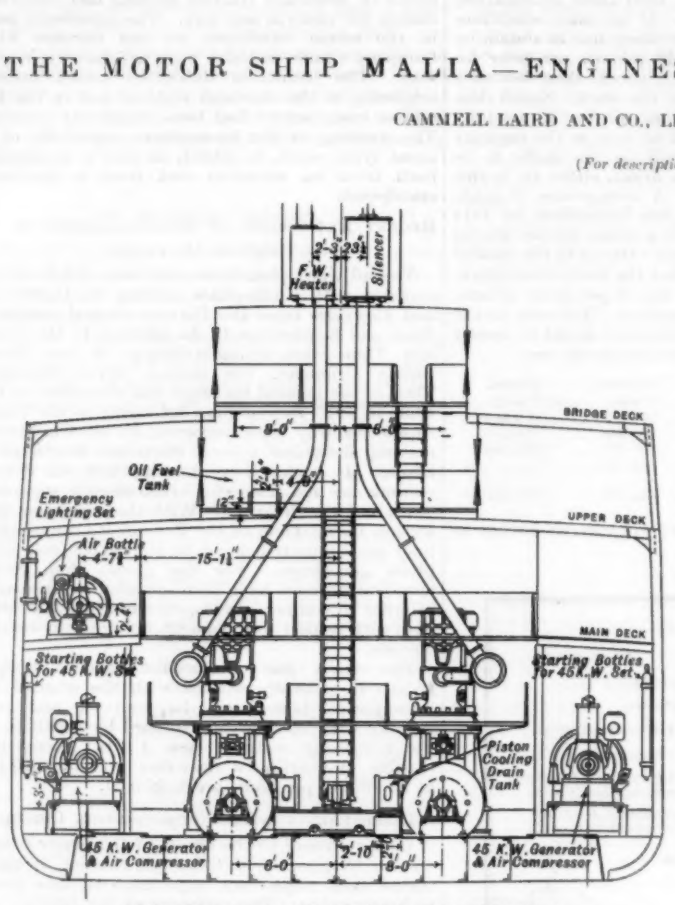
Herr Thormann concludes by stating that it caused him the greatest surprise to read recently in the technical journals that both the French and the British railway companies had decided in favour of the continuous-current system at 1500 volts.

The Commercial Counsellor at Shanghai, Mr. H. H. Fox, C.M.G., has notified the Department of Overseas Trade that the majority of United Kingdom manufacturers who communicate with him direct asking for the names of suitable firms to act as agents for the sale of their products in China, do not accompany their inquiries by catalogues, price lists or illustrations of their goods, and even when these are sent the number is usually limited to one or at the most two copies. Mr. Fox suggests that United Kingdom manufacturers, when forwarding him inquiries for agencies, more particularly in the case of engineering specialities, should send at least six copies of their catalogue or illustrations for distribution amongst local firms in China. It is desirable to quote prices in such publications, even if they are only approximate.

THE MOTOR SHIP MALIA—ENGINES AND ENGINE-ROOM ARRANGEMENT

CAMMELL LAIRD AND CO., LIMITED, BIRKENHEAD, ENGINEERS

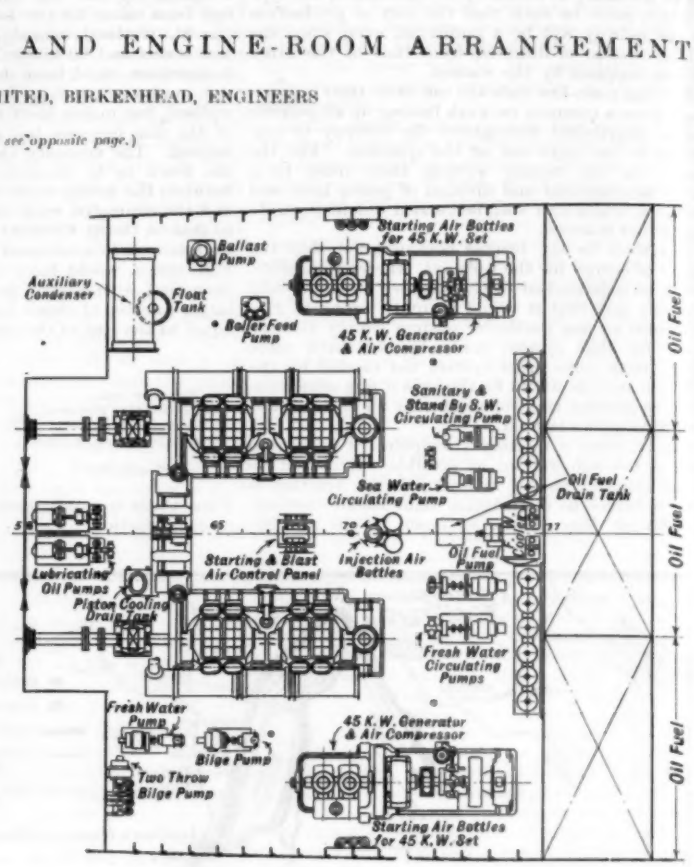
(For description see opposite page.)



SECTION AT FRAME 62 LOOKING FORWARD

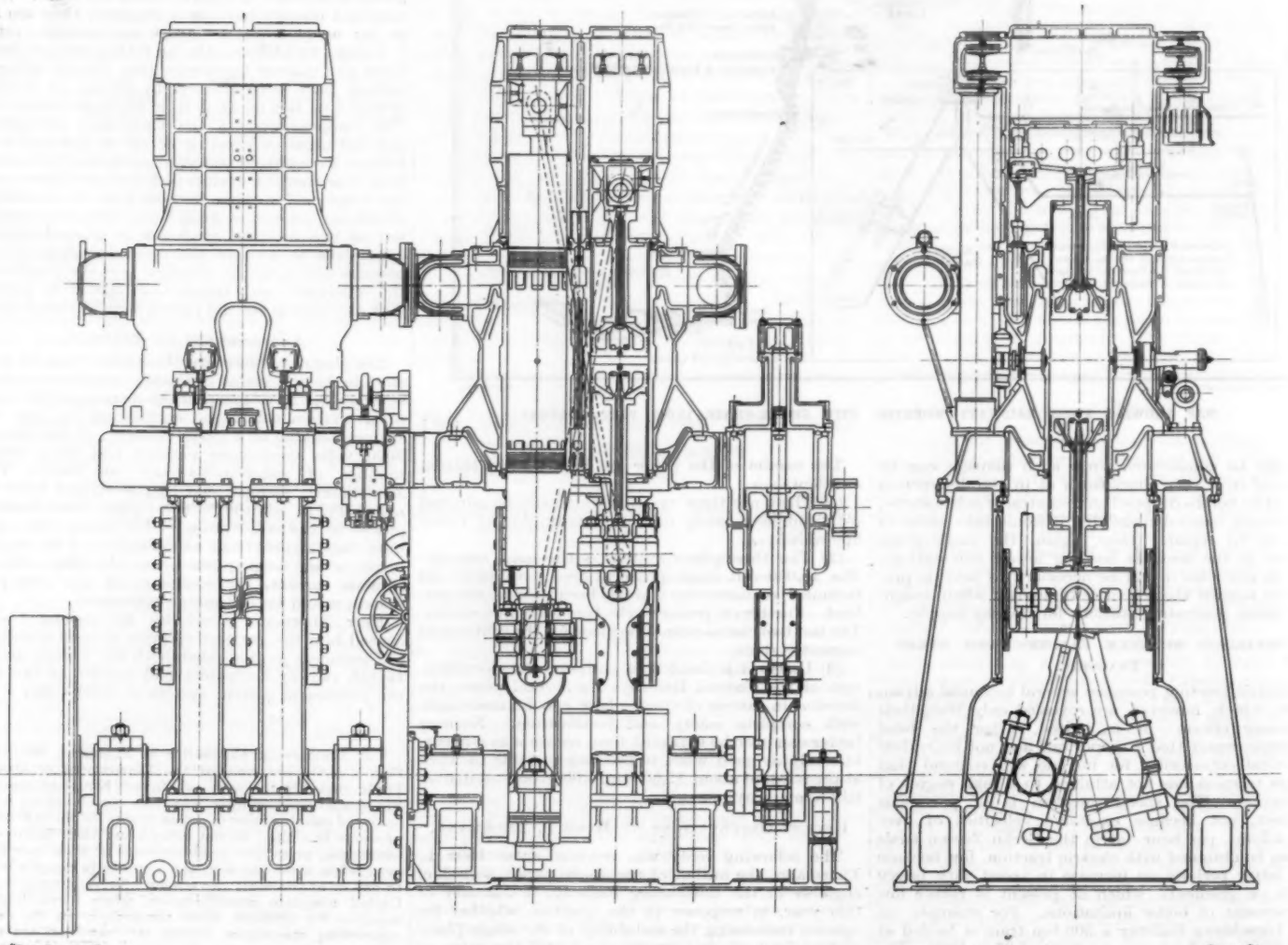
"THE ENGINEER"

CROSS-SECTION THROUGH ENGINE-ROOM



SWAIN Sc.

PLAN OF ENGINE-ROOM



"THE ENGINEER"

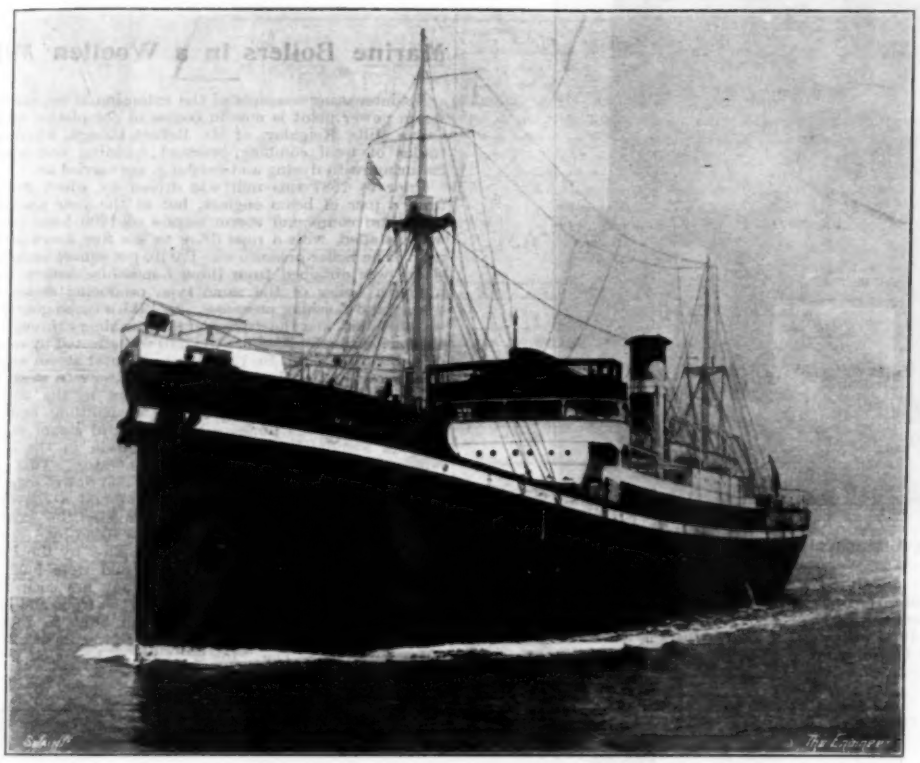
SWAIN Sc.

500-H.P. CAMELLAIRD-FULLAGAR ENGINE

The Motor Ship Malia.

One of the most recent vessels to be fitted with the Camellaird-Fullagar type of oil engine is the Malia, of which we reproduce a photograph, and which ran her trials on September 29th. She is a ship of 3880 tons gross, measures 365ft. long overall by 50ft. by 37ft. 3in. depth moulded, and has a capacity of 6000 tons deadweight on a draught of 23ft. The Malia is owned by Thos. and Jno. Brocklebank, Limited, of Liverpool, and was built by William Hamilton and Co., Limited, of Port-Glasgow. The propelling machinery, by Cammell Laird and Co., Limited, of Birkenhead, comprises two sets of 500 horse-power engines, and is illustrated by the line drawings on page 378. We described this class of engine very fully in our issues of January 30th and February 6th, 1920, and it is thus unnecessary to explain in detail how the inventor has arranged four pistons, in opposed pairs, to work on two cranks, but it is interesting to compare the drawing in the February issue with the present illustrations, as it shows to what a small extent it has been necessary to alter the designs during the past year and a half. In fact, the chief interest in the Malia lies in the fine performance of the engines during the trials, when a speed over a knot in advance of that stipulated was obtained, and in the arrangement of the auxiliary machinery.

The main engines, as we have already mentioned, comprise two sets. Each of these is capable of developing from 500 to 550 shaft horse-power when running at from 120 to 125 revolutions per minute, and has four cylinders



THE MOTOR SHIP MALIA

14in. in diameter, with a piston stroke of 20in. It is noteworthy, in connection with this installation, that only two days were required to tune up the engines before commencing the official trials, and it is unlikely, the makers say, that they will go to the expense of running any more of this particular size of engine on the test bed, but will follow the steam engine practice of installing them in the ship direct without preliminary tests. The second of the two engines for the Malia was run at a load of 540 brake horse-power with a perfectly smokeless exhaust, and the scavenging air pressure required was only 1 lb. per square inch, a performance which is attributed very largely to improvements in the design of the ports.

It is the makers' usual practice to arrange for each engine to drive all the pumps and auxiliaries necessary to make it a self-contained propelling unit. In the present installation, however, for particular reasons of the owners, the oil and water circulating pumps are separately driven. Sea water, fresh water, circulating and lubricating oil pumps have all been duplicated, each pump being of a capacity large enough to supply all the necessary water or oil, as the case may be, for running both engines. This scheme allows one pump of each set to be used at work whilst the other is a stand-by.

Two combined dynamo and air compressor sets are installed, one on the port and the other on the starboard side of the engine-room. Each set is driven by a two-cylinder Petter hot bulb engine developing 78 brake horse-power at 300 revolutions per minute. Three small air bottles are supplied with each set for starting purposes. Each engine is direct coupled to a 45-kilowatt Allen dynamo, and through a clutch to a Reavell three-stage quadruplex air compressor capable of pumping 125 cubic feet of free air per minute to the bottle storage pressure of 1000 lb. per square inch. Twelve air bottles are fitted on the forward engine-room bulkhead for the storage of the starting air for the main engines. All the valves in connection with the injection air and starting air systems are mounted on a panel situated between the engines and are easy of access from the starting platform. All operations for starting or charging can be carried out from this panel.

Still further forward there is fitted a pedestal carrying the injection air bottles, one working bottle being supplied for each engine, and a similar bottle as spare, which may be switched on to either or both main engines as desired. An auxiliary air receiver of 30 cubic feet capacity, storing air at a pressure of 200 lb. per square inch, is fitted in the 'tween deck at the port side, for supplying air to the windlass, donkey boiler feed pump, oil-firing gear and ballast pump, when the donkey boiler is not in use or when steam is being raised. The turning gear for both engines is driven by one 4 brake horse-power English Electric Company electric motor with a cross shaft and worm gearing.

In addition to the two main generators, an emergency lighting set, fitted on the port side at the main deck level, is driven by a single-cylinder hot-bulb engine of the Petter type, developing 10 horse-power when running at 425 revolutions per minute. The dynamo is of 5 kilowatts capacity, and was manufactured by Allen's. A separate fuel tank, air bottle, and hand-driven air compressor are supplied with this set to make it entirely independent of the ship's supply of air or fuel in case of emergency.

Two electrically driven lubricating oil pumps are fitted in the recess at the after end of the engine-room, each of them being capable of delivering 2000 gallons of oil per hour. The pumps are of the Albany gear type, and are driven through reduction gearing by a 2 horse-power English Electric Company's motor. Double strainers are fitted on both the suction and delivery sides of the pumps. An electric alarm bell indicates when the oil pressure falls below a safe limit.

Fresh water is used for cooling the jackets and piston heads, two pumps being fitted forward of the engine on the starboard side for this purpose. Both pumps are of the Albany gear pattern, and are each capable of supplying 9000 gallons of water per hour. They are driven through reduction gearing from 10 horse-power motors. The fresh water for cooling purposes is passed through a cooler fitted on the forward engine-room bulkhead, the cooling medium in this case being sea water. Two pumps are fitted on the port side forward of the engine for supplying this water. The pumps are of the Drysdale centrifugal pattern, direct-coupled to a 7 horse-power motor, and are each capable of delivering 9000 gallons of sea water per hour. These pumps may be used alternatively for supplying water to the ship's sanitary system. For cooling purposes for the hot-bulb engines arrangements have been made to use either sea water or fresh water, whichever is more convenient. An electrically operated alarm valve is fitted to the fresh-water system to indicate when the pressure falls below the working limit.

Two settling tanks are fitted on top of the main bunkers at the forward end of the engine-room. Each tank is of a capacity great enough to run both main engines and all the necessary auxiliaries for twenty-four hours. Fuel is supplied to these tanks from the main bunkers by means of an electrically driven rotary pump, gear-driven from a 1½ horse-power motor. A hand pump is fitted to the filling system for use in case of failure on the part of the electric pump. Double strainers are fitted on both the supply and delivery sides of the tanks. Steam heating coils are fitted in each of the settling tanks.

The exhaust from the main engines is led up the funnel, two silencers being fitted inside the funnel casing. The silencer on the port side is fitted with a water jacket through which fresh water is fed from a gravity tank on the bridge deck. This service is to supply hot fresh water for ship's use. The exhaust pipes from all the hot-bulb engines are led into this silencer, thus ensuring a supply of hot water when the ship is docked and only the auxiliaries are running. Hot water from the engine circulating system may also be used for warming the fuel oil in double bottom in cold weather.

Fuel is stored in three cross bunkers and in one double-bottom tank. The total quantity carried will be about 450 tons, and as the engine will consume less than 5 tons per day, sufficient fuel for a long voyage will be available. As she will be used on the London-Calcutta route, she will be able to bunker at the cheapest oil port on the run. Electric steering gear of the Hele-Shaw type has been fitted, so as to enable the donkey boiler to be completely closed down when the ship is at sea.

The engines were built and the whole of the machinery installed under the supervision of G. S. Goodwin and Co., of Liverpool. David Rowan and Co., Limited, Glasgow, fitted the propellers, shafting and all pumps in the engine-room not connected with the main engines, and the donkey boiler which is installed for driving the winches and capstan.

The sea trials were carried out on the Firth of Clyde on September 27th and 29th, and were, as we have already mentioned, quite satisfactory. The combined indicated horse-power of the two engines when running at 125 revolutions per minute was about 1570, which was equivalent to some 1100 brake horse-power. On the 29th, the average revolutions of both engines were 118 per minute, giving an indicated horse-power of 1480. The speed of the ship was 10.7 knots. The fuel consumption of these engines works out at 0.42 lb. per brake horse-power, or 0.29 lb. per indicated horse-power. The oil used was supplied by the Anglo-Mexican Petroleum Company, and was a standard Diesel fuel oil having a specific gravity of 0.904. The lubricating oil consumption was 0.003 lb. per brake horse-power per hour, which, it is expected, will be reduced as soon as the starboard engine has run itself in.

Some manœuvring trials were carried out, the engines being reversed from full ahead to full astern several times, and the complete operation taking from four to seven seconds. The absence of vibration in all parts of the ship was also very marked, the only noise of any magnitude coming from the auxiliary plant.

Gas versus Electricity.*

As soon as material was available, the British Commercial Gas Association set itself actively to combat the erroneous impressions created on the public mind by the publication of certain reports dealing with coal conservation and electricity supply, and by the use made of those reports by politicians engaged in fashioning visions of the imminent millennium—a task which is by no means ended yet, for truth is proverbially handicapped in the pursuit of the false.

It may, therefore, not be out of place to reiterate here the main points that have been established as to the relative effects upon the nation's coal resources of converting the potential heat in coal into electrical energy or into gas for the purposes of distributing that potential heat to those requiring fuel, as distinct from light or motive power. From the point of view of "coal conservation," there is no practical difference between gas and electricity when used for lighting or power purposes. But when it is heat for heating, cooking and furnace purposes that the consumer needs, the case in regard to coal conservation as between the two sources of heat supply is very different. Careful inquiry into this subject made by Sir Dugald Clerk, Professor Smithells, and Professor Cobb, resulted in their presenting to the Institution of Gas Engineers a report, which has never been seriously challenged, that sets out amongst other conclusions the following salient facts:—

(1) The average—not the worst, but the average—electric generating station of to-day destroys coal containing 100 heat units in the process of delivering to the consumer 7 heat units in the shape of energy—a loss of 93 per cent.

(2) The most efficient generating station of to-day shows a loss of 88 per cent., delivering to the consumer as energy only 12 heat units out of every 100 in the coal burnt under its boilers.

(3) The best result anticipated for the suggested "super" stations—but never yet realised in practice at any existing station, and there are some large units in use—is an efficiency of only 18 per cent.—82 heat units lost in generation and distribution for every 18 delivered to the consumer.

(4) Out of every 100 heat units in the coal carbonised at the "good practice" gasworks of to-day—in round figures—50 are returned to the solid fuel market as coke, 5 are recovered as tar, 22.5 are lost in manufacture and distribution, and 22.5 reach the consumer as gas; so that out of 100 heat units in the coal carbonised, 77.5 are delivered to the community and only 22.5 are lost, while out of heat units that do not reappear after the process of carbonisation as anything other than gas (22.5 out of 45 =), 50 per cent. are delivered as gas to the consumer.

(5) In the gasworks of the future it is possible that coal will be as completely as possible gasified, and that 75 heat units out of every 100 in the coal treated will be available for distribution as gas, as against 18 out of 100 available if the distribution be in the form of electric energy.

(6) After allowing in both cases for all losses in transmission and utilisation—that is, after giving electricity credit for its somewhat higher "efficiency of utilisation" than gas—there would be involved in the doing of equal heat work for the consumer the destruction of 4 tons of coal at the electric generating station of to-day, as compared with 1 ton at the gasworks of to-day; or 3 tons at the super-station of the future as against 1 ton at the gasworks of the future.

(7) To give the gas consumers of to-day equal service to that rendered them for a destruction—net—of 10 million tons of coal, the electric generating stations of to-day would destroy 40 million tons and the "super" stations 20 million tons at least—and in so doing would destroy all the valuable by-products recovered when coal is carbonised.

(8) To displace the 40 million tons of coal now used for domestic fuel by gas—these are figures deduced from

* Excerpts from Mr. D. Milne Watson's presidential address to the British Commercial Gas Association at Glasgow on September 27th.

Sir Dugald Clerk's data and the Coal Controller's estimated gas equivalent of coal for fuel purposes—a net destruction of only 30 million tons would be involved if gas carbonised at the works of to-day were used; whereas if electric energy were employed, 120 million tons would be destroyed at the generating stations of to-day, or 60 million tons at the super-stations if they proved as economical in coal consumption as promised.

* * * * *

The work that lies before the Association is primarily, as it has always been, to increase business and to combat competition. Never has there been a time when competition was more likely to be severe in the future than now. Gas has its old rival, coal, and its new rivals, oil and electricity, to contend with. In regard to electricity, the competition which has been felt now for many years is likely to be even greater in the future. Parliament is framing for that industry also a charter, Electricity Commissioners are already sitting, and it is proposed to erect large super-stations which will deliver cheaper electricity all over the country. Now there can be no objection to electricity being supplied cheaply so long as its cheapness is not the product of subsidy by public money, direct or indirect; but we, as an industry, must be prepared to sell light, heat and power still cheaper or, at least, as cheaply. It is true that we are able—and in the absence of cheap water power will, I believe, continue to be able—to hold our own in heating and cooking without difficulty if we are progressive in our methods and enlightened in our policy; but in lighting and power we have in many fields a most powerful rival. I think that the time may come when gas and electricity may work together in this country as they do elsewhere, each occupying the field where it is most suitable. It has, indeed, already been recognised in many quarters that gas and electricity should work together, but until such a time as that may come about we will have to take care that our business is not taken away from us through our negligence or backwardness, and that we are constantly on the look-out to guard and further our own interests.

Now the best way to expand business and to fight competition, as the Association has always recognised and as all undertakings will be wise to remember—for, be it said with emphasis, the general work of the Association, be it never so skilfully and thoroughly performed, cannot and must not be thought to diminish the need for particular, individual work in the districts of every undertaking—the best way to increase your output and to prevent your competitor from capturing your business is not by abusing him or decrying his wares, but by giving your customers, actual and potential, in the most attractive and convincing form, the fullest possible information about what you can do for them, and then, having secured their custom, serving them even better than you have led them to expect. In other words, by publicity at its best, backed by service at its best, you can secure all the business that is legitimately yours, and your competitor will have to be a very good man to beat you.

A SEQUEL to the high wages that, under standardisation, had to be paid for track work in the United States is that this work has been let by some companies to contractors, who are under no obligation to pay standard rates. It is not generally known that some British railway companies do their relaying by contract.

CONSTRUCTION OF LOCOMOTIVE ENGINES IN INDIA.

IN pursuance of its expressed policy of making India as far as possible independent of outside sources in the supply of materials for railways, the Government of India has had under consideration the question of the construction of locomotive engines in India, and it is now in a position to give a general undertaking that tenders will be invited annually in India for all the railway locomotive engines and locomotive boilers required by Government during the twelve years commencing with 1923.

It is estimated that the average annual requirements of Government will be 160 locomotive engines and 160 additional boilers during 1923 and 1924, and thereafter 400 locomotives and 400 additional boilers.

The first tenders will be invited on October 1st, 1922.

The following general conditions will be observed:—

(*a*) The invitation to tender will be published simultaneously in India and England, and will remain open for at least three months.

(*b*) The qualities of the article offered must satisfy in every respect the specifications laid down.

(*c*) The prices in the case of tenders made in India must compare not unfavourably with the imported article.

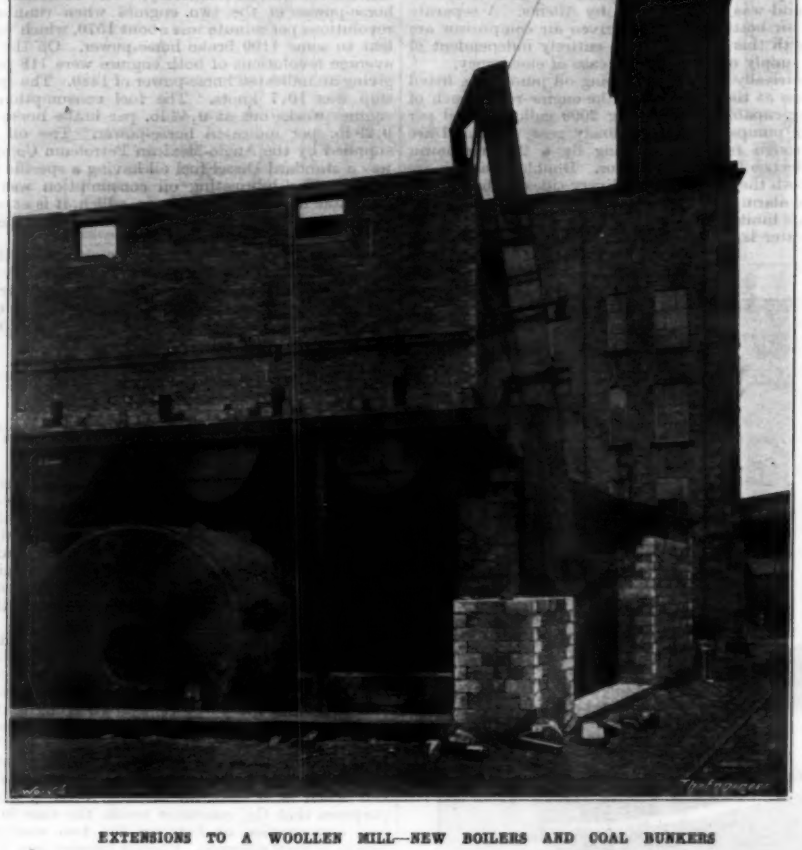
(*d*) Tenderers in India must satisfy Government in the earlier years that an appreciable part of the manufacturing will be done in India. This condition may be expected to become gradually more stringent, until eventually tenderers, in order to be successful, will be required to show that they can carry out in their works in India all processes usually carried out in locomotive works in England.

(*e*) Government will reserve the right to insist that the proposed sources of supply of parts which cannot be manufactured in India should be stated in the tender, and should be subject to their approval.

(*f*) Government will reserve the right of inspection at any stage of the process of manufacture, both in India and elsewhere.

(*g*) Firms receiving orders in India will be expected to provide facilities in their works for the training of Indian technical students, and where such firms have their main works outside India, or are subsidiary companies promoted by or closely connected with firms which have their main works outside India, they will be expected to provide thereat similar facilities for students recommended by the High Commissioner for India in London.

Firms interested in the above announcement are invited to apply for further information, either to the Secretary, Railway Department, India, or to the High Commissioner for India, London.



EXTENSIONS TO A WOOLLEN MILL—NEW BOILERS AND COAL BUNKERS

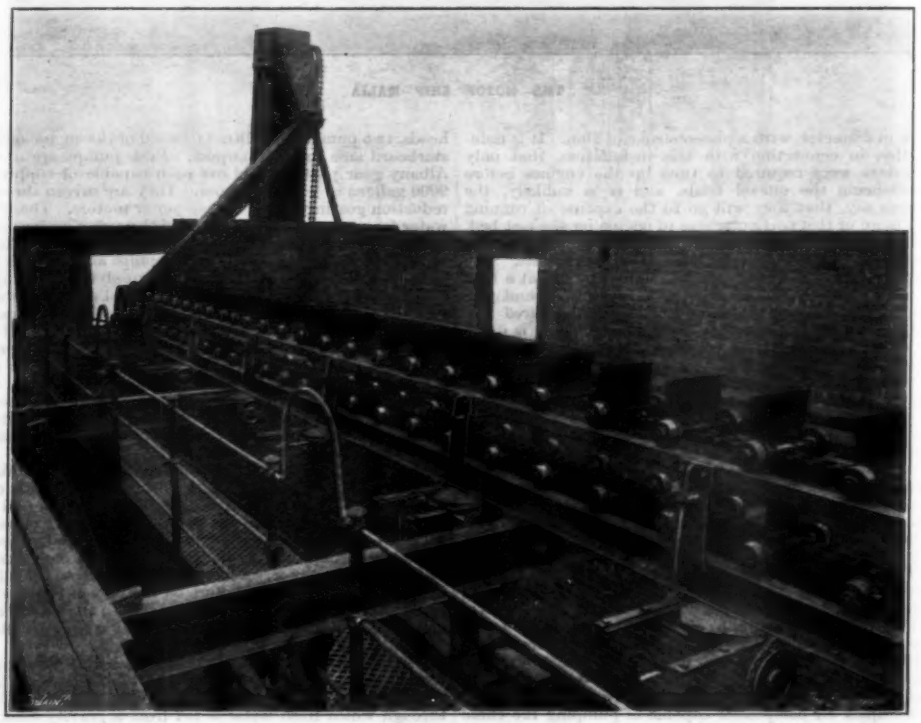
Marine Boilers in a Woollen Mill.

AN interesting example of the extension of an existing steam power plant is now in course of completion at the Grove Mills, Keighley, of Mr. Robert Clough, where the trades of wool combing, worsted spinning and manufacturing, with dyeing and finishing, are carried on.

Prior to 1887 this mill was driven by wheel gearing from a pair of beam engines, but in the year named a horizontal compound steam engine of 1200 horse-power was installed, with a rope drive to the five floors of the mill. The boiler pressure was 120 lb. per square inch, and steam was obtained from three Lancashire boilers, with a fourth boiler of the same type producing steam for dyeing and finishing processes. In 1911 a turbo-generator was installed, and the driving of the machinery throughout the various departments of the mill was effected by means of electric motors. In 1914 the horizontal steam engine was converted to drive an electric generator as a stand-by.

The present extension works—shown in the accompanying engravings—comprise the dismantling and removal of the 1200 horse-power horizontal steam engine and its foundations, and the installation in the same building of a 2500-kilowatt turbo-generator. Two new boilers of the "Inglis" type are being laid down, together with coal storage bunkers, an elevator and a conveyor. When these alterations have been completed the existing turbo-generator will, in turn, become a stand-by.

The two new boilers have been supplied by the Inglis Boiler Syndicate, Limited, Glasgow, and were built by Barclay, Curle and Co., Limited. They are each 14ft. in diameter by 11ft. long, exclusive of the front and back combustion chambers, and have been built to Lloyd s requirements and survey for a working pressure of 220 lb. per square inch. The "Inglis" type of boiler, of which we gave some tests in our issue of September 23rd, and which the inventor claims has an efficiency of 80 per cent., is similar to the ordinary cylindrical marine boiler, but has three furnaces, all connected at the back to one common combustion chamber. From this chamber a



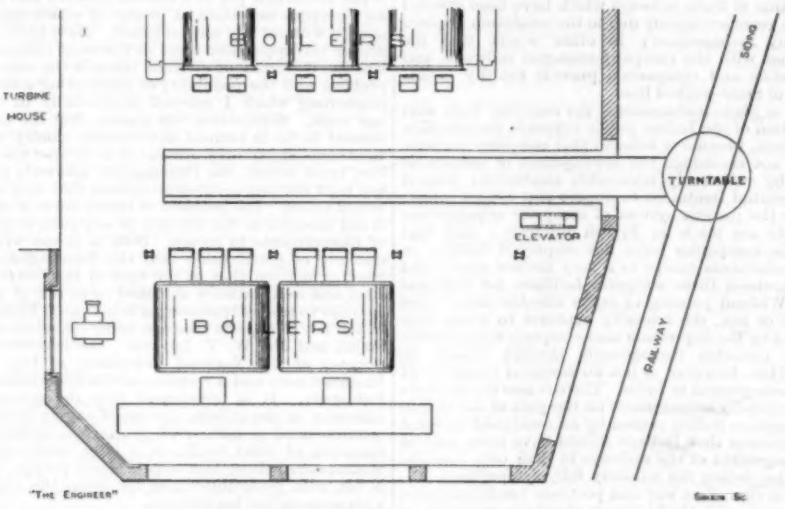
EXTENSIONS TO A WOOLLEN MILL—COAL CONVEYOR

return flue is led to the front end and opens into another brick-lined chamber extending over the entrance to all the tubes. The flame and gases from the three furnaces meet in the common combustion chamber at the back of the boiler, and are then thoroughly mixed and ignited in passing through the central return flue to the chamber at the front end. They then enter the tubes which extend from the front end plate to the back end plate of the boiler, the gases thus passing three times through the boiler. This arrangement ensures that the cold or green gases from each furnace, while being fired, become thoroughly mixed and ignited by meeting the hot gases from the other furnaces, thus giving practically perfect combustion with little smoke. A Sugden superheater is fitted in the front combustion chamber of each boiler, and is capable of superheating the steam to a final temperature of 620 deg. Fah. The three furnaces are fitted with Bennis mechanical stokers, which discharge the ashes at the back of the boilers.

The steel storage bunker—shown in the line drawings—together with its supporting structure, the coal elevator and the conveyor, have been supplied by S. S. Stott and Co., of Haslingden, near Manchester. Coal is brought by rail to the firm's private siding, the wagons passing over a turntable into the boiler-house, and discharging by side or end doors to a revolving feeder over the elevator boot. The elevator is 51ft. 7in. centres, of the enclosed steel-cased type, and has a capacity of 10 tons per hour. It is fitted with stamped steel buckets, 11in. long, which discharge by a chute through the flat roof of the bunker superstructure to a horizontal scraper conveyor, 32ft. long between the centres. The conveyor has six outlets for discharging the coal over the storage bunkers. The three bunkers are of steel plate, ⅜in. thick, 7ft. 4in. deep in the centre, and 20ft. 8in. by 12ft. at top. They have a combined capacity of 150 tons of coal. Discharge shoots are fitted to the underside of the bunkers leading to the stoker hoppers on the two new 'Inglis' boilers, and the three existing Lancashire boilers.

In view of the great size of the new boilers and their weight—45 tons each—the means of transport from Glasgow to Keighley called for special consideration. They were conveyed by steam traction engines from the boiler works to the large crane belonging to the Clyde Trust at Finnieston Quay, Glasgow, and loaded into a steamer for Manchester Docks, where they were discharged by means of the Ship Canal Company's new 60-ton floating crane, described in THE ENGINEER of July 15th. The boilers were then transported by road from Manchester to Keighley. The size and weight of the load being so abnormal, a careful survey had to be made of several possible routes, so as to avoid any road bridges of insufficient strength. The bogie for carrying the boilers was specially constructed for this particular traffic as a first load, the depth of the bogie being kept at a minimum so as to ensure a clear passage beneath several railway bridges. Separate journeys were made with the two boilers, two traction engines being used on each occasion. Each outward journey, a distance of about 50 miles, was made in two days. The width of the load necessitated the holding up of tramway traffic for short periods on some of the narrower roads *en route*, but both boilers were delivered on the site without mishap.

The photographs from which our half-tone engravings are reproduced were taken during erection of the plant and before the addition of the flat roof over the bunker superstructure, or the roof over the new boilers, so as to show the coal bunkers, the conveyor, and so forth.



PLAN OF NEW BOILERS AT A WOOLLEN MILL

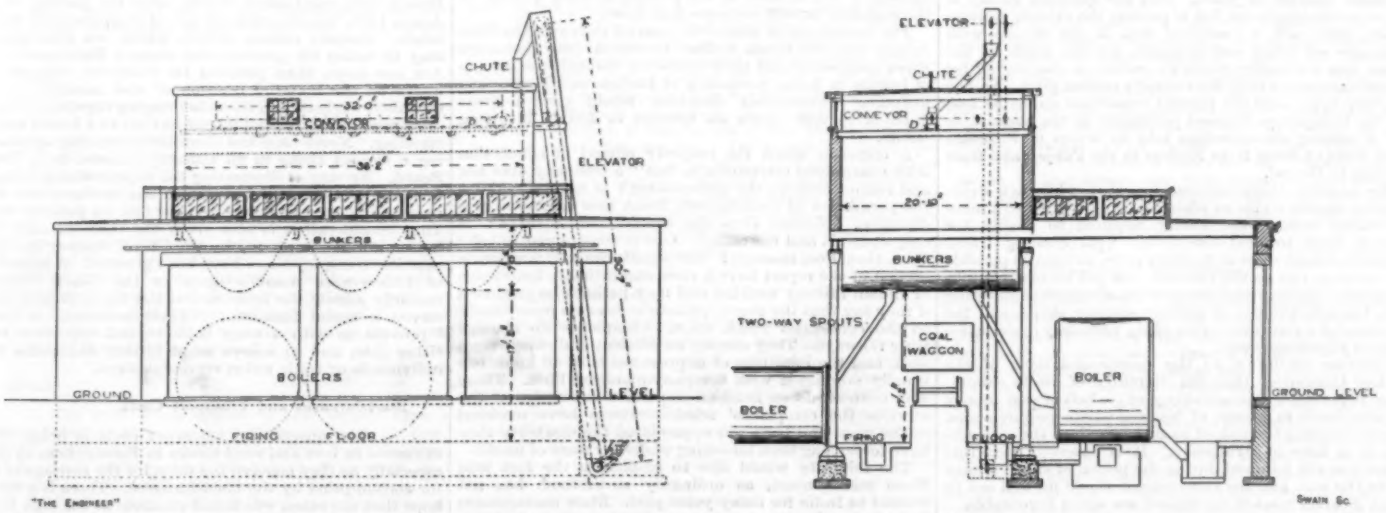
20-Ton Steam Goliath Crane.

A GOLIATH crane which has just been constructed by Butters Brothers and Co., of Glasgow, for Sir W. G. Armstrong, Whitworth and Co., Limited, Newcastle-on-Tyne, is shown in the half-tone engravings on page 374 as it appeared before the canopy was erected over the driver's platform. It has been built for a span of 60ft., with a clear lift of 32ft. to the underside of the cross girders, and the following speeds are employed in the various operations, viz.:—Lifting full load of 20 tons at 18ft. per minute, lifting 5 tons at 70ft. per minute, traversing 20 tons at 80ft. per minute, travelling 20 tons at 200ft. per minute. The structure is of the open latticed type, built up of rolled steel sections, well braced and gussetted together by plates and angles, &c., and is mounted on eight cast steel double-flanged rail wheels of 2ft. diameter on the tread. The wheels are fixed on steel axles running in gun-metal bushed bearings. An auxiliary girder is carried on one side of the crane to form a platform and to carry the tumbling brackets which support the longitudinal square shaft for the travelling motion. This motion is transmitted by vertical shafts and steel spur and bevel gearing to two rail wheels on each side of the crane. The whole of the movements of the crane, viz., lifting, traversing, and travelling, are operated from the crab, the frame of which is constructed throughout of British standard rolled steel sections, and is mounted on four large steel double-flanged rail wheels. The crab is traversed along the main girders by bevel and spur gear which connects the main engines with one rail wheel on each side of the crab.

The engines are of the double-cylinder type with cylinders 8¾in. diameter by 12in. stroke, and are fitted with link motion reversing gear. The boiler is of the vertical type, 4ft. 6in. diameter by 9ft. 6in. high, and is intended to work at a steam pressure of 80 lb. per square inch. It is placed on the opposite side of the crab to the platform and is provided with a large steel coal bunker. A tank, capable of holding 300 gals. of water for the boiler, is fitted under the platform. A steam trap is fitted to the engine exhaust and the condensed steam is drained into the water tank. The machinery and the operator's platform are covered by a canopy of curved galvanised corrugated sheeting.

The hoisting gear is operated by treble-purchase machine-cut spur gear which provides two speeds, so as to give a quick speed for loads up to 5 tons. Two brakes are fitted on the hoisting motion—a mechanical brake and an automatic brake. The mechanical brake is of the band type, operated by a foot lever from the operator's platform, and is capable of holding and lowering the full load. The automatic brake is arranged to be operated by the load on the hook of the crane. This brake is normally on when the barrel is running in the lowering direction, and off in the hoisting direction. It is operated by hardened steel rollers of nickel steel enclosed in the steel-lined pockets of a subsidiary ring bolted and keyed to the hoisting drum. These rollers engage with a cast steel brake rim. The rollers are assisted in engaging in all positions of the brake by small compression springs in sockets with cast iron cod pieces accurately machined for their position. The standing end of the hoisting wire rope is carried on a compensating pulley attached to levers connected to the brake strap, and the braking action is proportional to the load on the lifting block, but being slightly in excess of this, the load is held until forced to descend by the use of the engines.

The crane is shown in the illustrations fitted with a two-pulley return block, from which is suspended a forged hook supported on a ball-bearing swivel housing. Although not shown in the engravings, the hook of the crane is provided with block-setting gear with locking and turning gear for setting large concrete blocks at various angles. Ladders and hand rails are provided to give access to the platform of the crane, to the operator's platform, and also across the crab for lubricating the machinery. The total weight of this crane in complete working order is 45 tons, and the maximum pressure on any pair of rail wheels under the worst conditions of loading is 23 tons, or 11½ tons on any one rail wheel. The crane was tested in all motions to 50 per cent. overload, viz., 30 tons.



GENERAL ARRANGEMENT OF BOILERS AND COAL BUNKERS AT A WOOLLEN MILL

The Future of the Railways of India.

No. II.*

WE conclude our *résumé* of the Report of the Committee, of which Sir William Acworth was chairman, appointed to consider the administration of Indian railways.

MANAGEMENT AND FINANCE.

The Committee is unanimous in advising that management by companies domiciled in England should not be continued after the termination of the existing contracts. It is agreed that a system of management by a combination of English and Indian companies is impracticable. It is, however, unable to agree as to the relative merits of management directly by the State and indirectly through companies domiciled in India. Five members support State management and five are opposed to it. As the first five includes the chairman, it is the technical majority, and in what follows Sir William Acworth and his supporters will be referred to as the majority and Sir Henry Burt and his colleagues as the minority.

THE VIEWS OF THE MAJORITY.

Few people will be found to deny that a company, investing its own money, managing its own property, and judging its officials by their success in producing results in the shape of dividends, usually conducts its business with more enterprise, economy, and flexibility than are found by experience to be attained in businesses directly managed by the State. But the property entrusted to the management of the companies in India is not their own, and their financial stake in the undertakings is, as the report shows, relatively very small. The management of the undertakings is nominally entrusted to the several guaranteed companies. The Government, feeling itself to be the real owner and ultimately responsible for the policy pursued, has always refused to leave any initiative in the hands of the companies.

On the board of directors of each company is a Government director, who has power of veto. The freedom of the board and its officials to act is confined in nearly every direction by the Government. The company does not retain control over its own revenue receipts or regulate its own revenue expenditure. The current cash receipts

* No. I. appeared September 30th.

have to be paid into the Treasury. Such moneys as may be necessary to meet current expenditure are furnished to the company out of the Treasury as required—subject to restrictions prescribed by the Government and not necessarily to the extent desired by the company.

The conclusion of the majority is, in a word, that the guaranteed companies do not possess the essential attributes which belong to ordinary companies. To claim that, because ordinary companies possess the advantages of energy, enterprise, and so forth, therefore these particular companies may be expected to possess these advantages, is to be misled by a mere name. But it is to companies substantially of the same nature as the present English companies that the minority proposes to transfer the management of Indian railways. It suggests that Indian companies—which would never have more than a minority interest in the undertakings—shall be entrusted with the management, and that the Government, remaining the predominant partner, shall appoint one-half of the directors and nominate the chairman, and so retain control. The majority does not think that the change of domicile of the board of directors would make the scheme workable. The division of responsibility between the Government and the boards which has hitherto existed is, in large measure, responsible for the failure of the Indian railway system to meet its obligations to the public. The majority cannot believe that executive officers, with a divided allegiance to the boards of directors which appoints and pays them, and to the Government authority which stands behind the directors, can ever do the best work of which they are capable.

One further point is that the directors of the guaranteed companies have grown up with the present system. Many of them are retired Indian railway officials who have borne the yoke in their youth. That competent boards of directors could be found at the outset in India is open to doubt, for strong opinions to the contrary were expressed by representative European witnesses in the presidency towns. The majority feels certain that if prominent business men, accustomed to ordinary commercial methods, were to join boards and then find their powers limited by Government control and Government regulations in any measure comparable to those which exist at present, they would very soon resign their posts.

Unless management is substantially independent the justification for the independence of a company disappears. And therefore, approaching the question, not as one of national sentiment, but purely from the practical point of view, members forming the majority find themselves in agreement with the almost unanimous opinion of Indian witnesses and recommend that the undertakings of guaranteed companies, as and when the contracts fall in, be entrusted to the direct management of the State. To the Government departments concerned, as at present constituted and administered, the majority would hesitate to entrust any new responsibilities in respect either of State or company-managed railways.

The majority, therefore, does not hesitate, though most of its members approached the question with a strong prepossession in favour of private enterprise as a general proposition, to recommend that in India the State should manage directly the railways which it already owns. Its colleagues, the minority, have adduced lengthy statistics which they consider prove the inferiority of State management in India. As to these the majority observes that the figures would have been more persuasive if the comparison had been made of like with like, or even if all the State-managed lines had been compared with all the guaranteed companies' lines and not with a selection from them.

Dealing with the question of how additional capital should be raised, the majority admits that the need for large capital expenditure for fresh railway development is great, and will, as far as can be seen, continue for an indefinite number of years. But the question to-day is not one of development, but of putting the existing railway system into such a condition that it can handle with reasonable efficiency and dispatch, not the traffic of the future, but the traffic which at present is clamouring for accommodation, which the railways cannot give. No one can fully appreciate the present conditions unless he has, like the Committee, listened personally to the lamentable tale of railway shortcomings told by scores of witnesses in all parts of India from Madras to the Punjab and from Bombay to Bengal.

The majority therefore considers that, while new development should, so far as possible, be postponed to a more convenient season, the money required to enable the existing lines to deal adequately with existing traffic should be raised, even at to-day's price, as soon as possible and spent as fast as the railways can put themselves into a position—by the recruitment of an adequate engineering staff, the enlargement of railway erecting shops, and the assurance of a continuous flow of the necessary materials—to use it advantageously.

Attention is drawn to the recommendations of the Mackay Committee that the Secretary of State should, as far as possible, take advantage of periods of easy money to raise funds in excess of his immediate requirements, thus minimising the risk of having to reduce the expenditure at a time of stringency. It is observed that this advice was not followed during the period of cheap money before the war, and the Government would do well not to forget it when market conditions are again favourable.

The Views of the Minority.

It is admitted on all hands that the State in the past has been fitful and parsimonious in its contributions to railways; it is this failure on the part of the State to provide for the crying needs of transport which is responsible, more than anything else, for the complaints made by the public against railways, and though a separate railway budget is administratively possible and may conceivably give more stabilisation, it would not in itself produce more money. For the future, as regards railways, the State has not only to face the increased expenditure required to meet the deterioration caused by the war, but also to provide the increased facilities for traffic demanded by trade, consequent on the new industrial development, estimated to cost fully Rs. 30 crores per annum—say, £20,000,000—for some years to come, without making any provision for the construction of new lines.

A fundamental fact which must not be overlooked is that the reforms of 1919 have created a new Legislature which has a great measure of control over the budget, and India is at the beginning of a new era which is designedly one of transition. As she advances in the direction of becoming a democratically governed country she will be faced with dangers which lurk in the handling of a commercial business through the agency of a State service and which experience elsewhere condemns. India cannot ignore these dangers, even though they may not be immediately imminent.

An important and weighty section of opinion, including that of the Railway Board, is opposed to the view that State management is the best, holding that, as railways are primarily commercial undertakings, they should be managed on a commercial basis, so as to secure economy and efficiency—that is to say, by a board of directors. The following are held by the same body of opinion to be some of the defects in State management:—(1) Constant transfers of senior officials, resulting in lack of continuity of policy; (2) the tendency to give promotion on the grounds of seniority alone without sufficient regard to efficiency or local knowledge; (3) disregard of public opinion; and (4) lack of initiative and flexibility. Further, as regards the co-existence of company-managed railways and State railways, it is urged that improvements in the administration of State railways which have been effected during past years are mainly due to the emulation inspired by company management; in other words, that the initiative lies with the company-managed railways, and that emulation and comparison provide healthy results in the case of State-worked lines.

Turning to State management, the minority finds that a large section of the Indian public supports the adoption of that system, because it believes that company management does not encourage the development of indigenous industries by sufficiently favourable treatment; that it gives preferential treatment to import and export goods; that under the present system of company management large profits are made in British interests; and that hitherto the companies have not employed Indians in higher appointments except to a very limited extent and have not granted them adequate facilities for technical training. Without pausing to argue whether these views are correct or not, the minority ventures to think they are coloured by the impression that company management necessarily connotes management through boards in London. That, however, is not an essential condition of company management in India. There is also the negative dislike of company management on the part of the Indian public, a positive feeling caused by an awakened national self-consciousness that Indians should have more control in the management of the railways in their own country, and with this feeling the minority fully sympathises.

It is quite clear that war and post-war conditions have had much to do with the high cost of railway operation in all countries, and that figures can be given showing the financial difficulties of company-operated lines; but State operation, hampered by standard rates and standard wages, is bound to be slow in getting back to normal conditions, and through lack of elasticity is likely to be far behind company operation in hastening on recuperation. The minority attaches much weight to the fact that the Indian railways, with the balancing effect of company-managed lines, in spite of the serious handicap of inadequate facilities, and with a comparatively moderate increase of rates and fares, have not fallen with the low financial state of railways of many other countries. It is confident that the result would not have been the same had all the railways been operated by the State.

Comparisons, all favourable to company management, in various details are given between the Bengal-Nagpur, East Indian, Great Indian Peninsula, Bombay, Baroda and Central India, and the Madras and Southern Mahratta company-worked lines, and the North-Western, Eastern Bengal and the Oudh and Rohilkhand State-managed railways; but in view of the protest, already quoted, of the majority we will not reproduce them.

The conversion of those two arterial railways, the East Indian and the Great Indian Peninsula, into domiciled rupee companies and their operation through the agency of boards in India, consisting of Indians and Europeans, including Government directors, would give a great impetus to and create an interest in Indian investing circles.

A criticism which the majority offered in connection with guaranteed companies is that "a company does not and cannot manage the undertaking; it cannot, without the permission of Government, break new ground in any direction. Neither does the Government manage; it only controls and restrains." One is constrained to ask: Who, then, does manage? The signatories to this separate section of the report have a close and intimate knowledge of Indian railway working and may perhaps be pardoned if they say that the above quotations bear no resemblance to the conditions which exist. Companies do manage their railways. They employ an efficient and experienced staff, and the initiation of improvements of all kinds has usually originated with company-managed lines. Those who criticise do so from an imperfect knowledge of the services the companies' administrations have rendered in the past, and have not appreciated the disability they have for so long been labouring under for want of funds.

The minority would like to emphasise the fact that State management, as ordinarily understood, has not existed in India for many years past. State management in India has become a reflex merely of company management. Following on the quasi-independence of the companies, Government has deemed it advisable to endow the agents of the State-operated lines with powers similar to those granted to the agents of the several companies, with the result that the former have been free from that amount of petty control and interference from headquarters to which they would undoubtedly have been subjected had there been State working only in India.

The Deutsche Bergwerkszeitung reports that the German Union of Manufacturers of Agricultural Machinery and Tools has decided to raise the prices of its products by 10 to 15 per cent. This rise, which nullifies the fall which took place about a year ago, is ascribed to the increased cost of production. The new prices come into effect at once.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

October Quarterly Meeting.

The October quarterly meeting of the Midland iron trade took place in Birmingham this week, and resulted in the holding of some important mutual meetings of ironmasters from all parts of the kingdom. The immediate condition of the iron and steel trades has naturally provided the most important matters for the exchange of views, and unfortunately there has been nothing very bright to report from any part of the kingdom concerning these businesses. At the quarterly meeting itself on 'Change on Thursday there were few inquiries of a definite character for supplies during the new quarter, and after their experience of the past few weeks producers were not inclined to attach much significance to general inquiries. Effective demand gains little perceptible strength. There is not much new pig iron coming forward and a negligent air pervades negotiations, many of which appear to be opened without any serious intent. Next to the iron trade proper the uppermost topic in the most influential circles was the Government attitude towards the unemployment problem and the possibility of engineering a better trade, concerning which I referred prominently in this letter last week. Satisfaction was general that the Government seemed to be in earnest in exploring sundry methods of treatment apparently calculated to relieve the situation; but, truth to tell, the Birmingham quarterly meeting did not hold out any great expectations that very much good would result. The problem of better trade is one which it is not thought in this district, at any rate, is in the hands of Governments to secure. Still, it is not without some measure of gratification that the Birmingham quarterly meeting noticed that in the eyes of the Government the steel and iron industry is looked to as one of the hopeful avenues to trade expansion, as is indicated by the inclusion in the list of experts who are being consulted of Sir Alan Smith and Mr. W. T. Layton. The last authority is a director of the National Federation of Iron and Steel Manufacturers and a member of the Federation of British Industries. It is understood that the question of the extension of the existing system of export credits is being recommended in influential quarters in preference to the financing of relief works on a large scale, and Midland ironmasters believe that this is sound policy. The future is big with possibilities, and for them the markets wait with more or less hopefulness.

Trade Boards in the Midlands.

There is no question that the majority of employers in the Midlands are opposed to the Trade Boards and do not regard their working in the future with satisfaction. There is abundant evidence of this hostility in various directions emanating from Birmingham. It should not be assumed, however, that this opposition is at all unanimous nor that an impartial review of what the Boards have accomplished in this district would not supply a fair amount of evidence of the advantages which have attended their establishment. In the area of which this city may be regarded as the capital there are no fewer than twenty-six of these Boards in existence, and the number of people concerned runs into hundreds of thousands. The trades of a metalliferous character are, however, only very few, being practically confined to the chain trade, the manufacture of iron and steel stamped and spun hollow-wares and the production of stamped and pressed metal wares. A few of these Trade Boards were established shortly after the passing of the Act in 1909, but the majority are of comparatively recent origin. Despite certain defects which are admitted, it may be taken for granted that around Birmingham the Act has more than justified its existence, that it has improved the material position of vast numbers of unorganised workers, and that the bringing together of representatives of capital and labour has led to a better understanding. Never once has there been anything approaching a serious strike in an industry covered by a Trade Board. By way of illustrating the improvement in wages the case may be quoted of women chainmakers, who now receive 7½d. per hour, as against 1½d. in pre-war days. That consideration is also given the cases of aged and infirm workers is proved by the liberal manner in which permits to employ them have been granted. A large firm of hollow-ware manufacturers in the Black Country candidly admits the opinion that the Trade Boards have served a useful function. "Their decisions," it states, "provide us with a wage basis beyond argument from either side, and so relieve us of further discussion with individuals or trade union representatives."

Blast-furnaces and Transport Costs.

The question of transport costs is being much discussed in iron and steel circles in Birmingham at date, especially as they concern the rates for the carriage of fuel for consumption by the blast-furnaces. There is a strong hope that the rates, which still continue at the high maximum of the war, will shortly be reduced, and action is being taken in some quarters to assist in bringing this about. Official notice has been issued that the railway companies have lodged a new classification with reference to the rates for the carriage of fuel. Hitherto a preferential rate has been given for fuel delivered to blast-furnaces. To South Staffordshire furnaces, which are far removed from the coke ovens and are always at a disadvantage in consequence, the concession is a very important factor. Pig iron is the basis of so many of our staple manufactures that any effective relief in production costs at the blast-furnaces is felt through a great many ramifications of trade. The Birmingham Chamber of Commerce has just decided to move in the matter along the line of exceptional rates for blast-furnace fuel, and for all the raw material used in the production of pig iron. It has been noted that the progress in the re-starting of blast-furnaces is not being maintained, for the reason that the market is not prepared to pay a price which would enable others to re-start. Up to the present the enterprise of furnace owners who

have resumed production has done nothing, so far as can be discerned, to stimulate the market. In its examination of the case the Birmingham Chamber of Commerce finds that in the producing districts which have the shortest haul for their raw material and fuel the railway charges on the inward carriage amount to about 28s. per ton of pig iron. South Staffordshire and other furnace owners whose plants are a considerable distance from the raw material have to pay 40s. per ton inward railway rates before they can put their pig iron on the market. Adding the cost of material and the high labour charges and setting these costs against the prices quoted for continental pig iron, the hopelessness of squaring the account needs no enforcement. On all hands, therefore, it is hoped that the efforts being made to secure the most favourable transport rates for blast-furnaces will meet with success.

Staffordshire Iron Trade.

The Staffordshire iron trade had shown practically no improvement during the week. A few mills are running for short periods of three or four days at a time, but as a rule this spasmodic activity is followed by rather lengthy periods of idleness. The market continues to be somewhat disorganised by the reduction of £2 per ton in Lancashire bars, making the selling price £14 as against the local figure of £16. The reduction has led to a demand from local consumers for similar prices for Staffordshire iron, and buyers continue to hold orders pending the lowering of prices in this district. Makers continue to express themselves quite unable to make a corresponding reduction. In isolated instances, however, it is stated, Staffordshire ironmasters have this week quoted bars at £14 at the works. Although they all state that production is unprofitable, it is firmly believed that the local quotation will shortly coincide with that of Lancashire. The last-named competing district has now brought down its hoops to £17 10s., as against £20 5s. quoted by Midland makers. So far the Staffordshire houses have not seen their way to follow even in this matter. Iron strip at £17 10s. finds a slow market. The situation in the galvanised sheet trade continues to be more hopeful and additional plant is coming into operation. Sheets are being sold in small lots. The foreign market shows a tendency to broaden.

Ironworkers' Wages.

The ascertainment of selling prices for July and August in connection with the Midland Iron and Steel Wages Board has been got out. The average price realised shows a fall which will carry a further reduction of wages from next week of 5 per cent. Two months ago a reduction of 80 per cent. took effect, and by next week the amount will have fallen under the sliding scale by 147½ per cent. since January. It will still be 117½ per cent. above the base rate. Anchor smiths and shackle makers in the Cradley Heath district have agreed to accept a reduction of 6d. per ton on all forgings.

Pig Iron Continues Cheaper.

All brands of pig iron are cheaper. Midland furnaces are making increasing sales of foundry iron to Manchester, where some revival of the cotton industry has set up a moderate demand for additional machinery. Northamptonshire forge iron is quoted £6 per ton delivered, with foundry iron at £6 10s. This is said to be the lowest quotation, although it is difficult to discover what is the minimum figure. Derbyshire No. 3 foundry continues at about £7 at the furnaces. Some quotations in North Staffordshire are as high as £7 10s., while in Northampton it is stated fairly heavy orders for forge iron are being booked at furnaces re-starting in about a fortnight, as low as £5 7s. 6d. at the furnaces. Large numbers of foundries in and around Birmingham continue wholly or partially idle. Quantities of pig iron continue to be put into stock owing to the poor demand from both foundries and forges.

Fuel.

Coalowners are concerned about the new demand for increase of miners' wages, which, if it materialises, will in their view prevent them making reductions to fuel prices which they recognise to be necessary for the revival of the iron trade. Coke and coal are decidedly cheaper this week, and this is reflected in the decline which is to be noted in pig iron values. Coke can be bought at about 22s. 6d. per ton at furnaces. Transport costs, however, are heavy to the Staffordshire blast-furnaces which are far removed from the coke ovens. They involve roughly an addition of 10s. per ton to the fuel, and furnace owners in the present state of demand are very shy about relighting furnaces. Coal can be bought at about £1 5s. per ton at the pits, representing a small reduction, but much cheaper fuel is considered essential.

Steel.

The steel works appear to have settled upon a general basis of £8 per ton for billets, a price fairly competitive with the most favourable offers from Belgium. The re-rolling mills continue fairly well off for work, and are now handling native material almost exclusively. A good deal of foreign steel has been cancelled through failure to make delivery. There is, however, a certain amount of Belgian steel coming in, chiefly consisting of wire rods, obtainable at £11, which is several pounds below the home quotation. An item which is causing some concern is the continued importation of nut and bolt iron at £9 5s. per ton. All British steel bars are down to about £13, but have a restricted sale against those rolled in the Midlands from cheap continental billets bought months ago. The price of these bars is £11.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

Iron, Steel and Metals.

THERE is very little indication of improvement yet in the Lancashire markets for iron, steel and metals. There is perhaps a hope that costs of manufacture may be brought down to a certain extent during the remaining months of the year; but it seems doubtful whether there will this year be the usual autumnal revival in demand. The handicap under which the engineering trades of the country are working is very heavy, and especially heavy where they come into competition with Germany; for iron, steel and copper are all much cheaper in Germany than they are here. The United States have also a great advantage over Great Britain in some of the iron and steel prices, and, of course, in copper; and although the wages bill is still higher there than it is here, the difference is not so great as it used to be. Engineering skill and prestige are what we have to rely on at present, but the trade needs also some sort of equality in working costs.

Metals.

The market for copper has been fairly steady for some time, but although the prices for standard and refined copper are low, there is no expectation of any immediate rise in price or improvement in the demand. There is an enormous quantity of Government scrap to be absorbed, and now that this is under the control of a body of traders no doubt a greater effort will be made to get it distributed amongst consumers of metals. This effort can scarcely fail to lessen the demand for new copper and brass, for the terms on which the traders have been allowed to acquire this Government metal are, if reports are to be believed, very low. It is suggested that the payment of a sum amounting to four millions in cash has tempted the Government authorities to allow the scrap to go at incredibly low prices, and that more than 150,000 tons of brass scrap have been handed over at from £22 to £25 per ton! We do not vouch for the accuracy of this statement, and, of course, the brass will not be put on the market at anything like these prices. Much of it is 70 : 30 material, and its intrinsic value at to-day's market prices for copper and spelter is about £56 per ton. The composition of the scrap being definite, it can be used by those who have to work to a definite specification, and this is a point of considerable importance when we are thinking of the effect its sale will have on the markets for the new metals. Hence, until some headway has been made in the distribution of this great mass of material, it seems probable that the copper market cannot advance very much. Tin has been rather quiet, and without the usual large fluctuations. The market is probably kept steady by the fact that the price is low on the one hand, and the fact that the supply is ample on the other hand. There has been some improvement lately in the demand for tin, but it is from the tin-plate trade and not from the engineering industry. The shipments from the Straits will be large for September. Lead has remained a steady market, but the available supplies are increasing, and it is doubtful whether there is any increase in the demand yet. One still feels that prices are higher than they should be. Spelter is a firmer market, and it does not yet appear that Germany is preparing to ship more metal to this country. Hence rather a sharp rise in prices is in progress. The truth is that there is a very steady improvement in the galvanised iron trade. This business had been very much curtailed by prices demanded for steel sheets, and consequently there has been a shortage in many countries. Sheets are beginning to get more reasonable, and, of course, spelter has been comparatively cheap for a long time. If the Continent does not swamp this market there is a good prospect for higher prices.

Foundry Iron.

There has been no sign yet of returning life in the foundry iron market here. Prices for the most part remain unaltered, but there has been a slight concession made in the price of Scotch No. 3 foundry, which is quoted at £7 7s. 6d. on trucks. When this comes to be translated into a Manchester delivered price, on merchant terms, it is, however, sufficiently extravagant, for a merchant could scarcely deliver the iron under £9 per ton. At the same time, East Coast hematite iron is being offered, delivered free to the Sheffield consumer at £7 15s.; so one may see how well justified is the disgust of the Manchester consumer of Scotch foundry iron. Derbyshire No. 3 pig iron remains at £7 to £7 10s., some sellers still asking the latter price delivered; and any Cleveland iron is offered on a basis of £6 at the furnaces, which means practically £7 here. Consumers of foundry iron, however, are in no hurry to buy, simply because they are not overwhelmed with orders for castings at present.

Finished Material.

The market here for finished iron and steel is quiet and dull. Small orders are being placed, but it is doubtful whether the aggregate of these can keep the mills going, and, indeed, two works on the East Coast and another two in Scotland are being closed. Probably when any consumer is able to place a large order for finished steel he is tempted by the prices to send it to the Continent, although he will have to wait for delivery. The smaller orders may be sent to British works at British prices because prompt delivery is essential. Altogether the situation is very unsatisfactory, and awaits a general setback in all the prices.

Scrap.

There is very little to be said about the scrap market. A slightly better feeling is perhaps noticeable in steel and wrought iron scrap, but the prices at which these materials can be sold (if they can be sold at all) are ridiculous when put beside the official prices for new material. For foundry scrap (cast iron) there is only a small demand, because of the lack of work for makers of castings in the district. The prices keep up fairly well, and the necessary fall is delayed by the price of pig iron.

The Institution of Mechanical Engineers.

The syllabus of fixtures for the North-Western Branch of the Institution of Mechanical Engineers has been arranged by the Local Committee, under the chairmanship of Mr. Charles Day, and the first meeting of the session took place on Thursday, the 28th ult., when about seventy members paid a visit to the textile laboratories of the Manchester College of Technology, where the chief processes and appliances used in the production of cotton yarns and fabrics were explained by Professor Turner and his staff. This visit was arranged with the object of familiarising the members with the manufacturing features of Lancashire's staple industry prior to the subsequent inspection of the spinning and weaving mills of Messrs. Ashton Bros., Hyde, and the textile machinery works at Messrs. Platt Bros., Oldham, which will take place on October 12th. By the generosity of some of the leading textile machinists of the district the equipment of some of the spinning and weaving laboratories has recently been overhauled and brought up to date. The machinery seen in operation included gins, bale breakers, mixing bins, openers and scutchers, carding machinery, sliver lap machines, ribbon lab machines, drawing frames, slubbing intermediate roving and jack frames and spinning room machinery, doubling and gassing, reeling and bundling machinery. In addition to the above, there is a complete equipment of the spinning of waste cotton which is actually used to spin the waste obtained in the ordinary processes of the spinning department. The spinning section is operated on a small commercial scale; the yarn made being taken over by the weaving section for the manufacture of cloth. The testing laboratory contains instruments and machines for making all kinds of physical and mechanical tests of fibres, yarns and fabrics. On October 27th, a dinner will be held at the Grand Hotel, Manchester, to be followed by an address by the chairman. On November 10th, the "Thomas Hawksley" lecture will be given at the Memorial Hall, Albert-square, by Dr. Hele-Shaw. On November 24th, at the same place, the paper by Mr. G. H. Salmon, D.Sc., on "The Machinery of Floating Docks," will be read and discussed, and on December 19th, Mr. Gardiner Mitchell will read his paper before this section on "Conveying and Elevating Machinery." The meetings will commence at 7 o'clock, and by the courtesy of the Committee of the Engineers' Club, the members of the Institution of Mechanical Engineers will be made temporary members of the club on each evening.

Manchester Association of Engineers.

The Manchester Association of Engineers opens its 1921–22 session on Friday evening next, when the President, Mr. Fred J. West, M.I. Mech. E., will deliver his inaugural address. Before doing so, he will present the Constantine gold medal to Mr. Julius Frith, for his paper read during last session entitled "Vibration," and the Butterworth gold medal for contributions to the discussions during the same period to Mr. Cecil Bentham, M.I. Mech. E. The meetings will again be held at the Memorial Hall, and with one exception, on Friday evenings instead of Saturdays, as in the past. The change of evenings will be welcomed by a large majority of the members of this old-established institution, and will probably be the means of inducing a large number of Manchester engineers who have hitherto held aloof from it to become members. As in the cases of the local branches of the Institutions of Mechanical and Electrical Engineers, the members will be made temporary members, on the evenings of the meetings, of the Engineers' Club, the home of which is adjacent to the meeting place. A very interesting series of papers has been got together. On October 28th, a discussion on the "Liquid Pressure of Iron in Moulds" will be opened by Mr. A. H. Goodger; on November 12th (Saturday) a paper will be read by Mr. Harold F. Massey, on "The Flow of Metal during Forging"; on November 25th there will be a discussion on "Foundry Costs and Establishment," which will be opened by Mr. Daniel Adamson, M.I. Mech. E.; on December 9th, Sir Dugald Clerk, F.R.S., will read a paper on "The Water Power of Great Britain and the Empire"; the President's conversazione will be held on December 16th. After an interval of four weeks—namely, on January 13th—a discussion on "Shop Management" will be introduced by Sir Henry Fowler; on January 27th, Mr. J. W. Curtis will read a paper on "The Organisation of Production"; February 10th is set aside for the anniversary dinner; on February 24th, Dr. Edward Ardern will give a paper on "Recent Developments in the Treatment of Manchester Sewage"; on March 10th, Mr. William Fox, M.I. Mech. E., will read a paper on the "Recent Developments on the Manchester Ship Canal"; and the final meeting will be held on March 24th, when a paper on "Commercial Motors" will be read by Mr. J. G. P. Thomas, of Leyland Motors, Limited.

The 12½ per cent. War Bonus.

In spite of the slump in the engineering industry and the steady increase in the number of workers out of employment at the present time, there appears to be a possibility that the trade unions will resist the reasonable proposition of the employers to take off the 12½ per cent. war bonus by gradual steps. At a meeting of shop stewards, held in Manchester a few days ago, a resolution was passed advising resistance to the employers' proposals, which, it is stated, will bring down the wages of skilled workers to £3 12s. 6d. per week. It will be a great calamity for the engineering industry if the workers do not fall in with the extremely reasonable proposals which are suggested, for there are few firms in this district that are not working at a loss at present, many of them carrying on with large overdrafts on their bankers, which cannot be increased, and unless the wages bills can be reduced it will not be long before many of these firms will be obliged to cease operations. The employers' proposal is that one-third of the bonus shall be taken off on October 12th, a second third on November 12th, and the remainder on December 12th, and it is generally considered likely that when these reductions have been given effect to there will be such a reduction in the prices of engineering wares that an immediate improvement in industry will follow.

BARROW-IN-FURNESS, Thursday.

Hematites.

Taking the whole of North Lancashire and Cumberland, there are now eight furnaces in active operation. There are two each at Barrow, Ulverston and Moss Bay, and one each at Millom and Cleator Moor. There is,

however, no very big demand for iron at present, and the situation remains very much the same, with consumers holding out for lower values before placing contracts of any weight. At least £1 a ton is demanded off existing rates. A cut of 10s. has been made this week, but further reductions are not an easy matter, for differences on the wage question between the mineowners and their men in Furness have not been adjusted, and then there is a question of heavy railway rates. These, of course, affect the trade throughout the country. The business being done now is for special deliveries.

Iron Ore.

In the hematite iron ore trade a fair tonnage of metal only is being raised. At the Roanhead mines in North Lancashire full time is being worked, and there is activity at Pennington, but the Park, Yarlside, Anticross and Newton mines are still closed down. In Cumberland ore is being raised at Hodbarrow and at mines in the Egremont and Cleator Moor district. Foreign ores are coming into Barrow

Steel.

The steel trade continues to be quiet. The orders on the books represent a small tonnage. At Workington rails are being rolled, and some of the other mills are engaged. At Barrow during this week work has been commenced at the furnaces, and it is probable that next week one or other of the mills will be put into operation. At present hoops are being rolled in fair tonnages.

Shipbuilding and Engineering.

There is a fair amount of activity only in the shipbuilding departments at Barrow. Vickers, Limited, on Tuesday launched the steamer Hudson Bay for the Commonwealth Government. She is similar to the Moreton Bay, now being fitted out, and a third steamer, the Jervis Bay, is on the stocks. The engineering shops are still on short time.

SHEFFIELD.

(From our own Correspondent.)

Return of the Steel Men from the States.

Easily the most interesting event in Sheffield steel circles since my previous letter has been the arrival home of the deputation of four who left for the States some weeks ago to lay before the Finance Committee of the Senate a protest against the severity of the proposed tariff on high-speed and other high-class steels imported into America. These proposals were made in what is known as the Fordney Tariff, and readers of this letter may remember that I was able to give, from information received personally from Mr. Arthur Balfour, the leader of the mission, a few details of how the deputation presented Sheffield's case before the Senate Committee. The party landed at Liverpool on Friday night from the liner Berengaria, and on reaching Sheffield the following day, handed to the local Press a written statement. The original idea was that the four representatives should address the American Chambers of Commerce, and by that means endeavour to influence public opinion in favour of a revision of the tariff proposals. It was recognised, of course, that the British Ambassador could take no active part in the mission; but, as a matter of fact, Sir Auckland Geddes used his good offices in such a way that the deputation found itself not before a Chamber of Commerce, but the Senate Committee. A full statement by the members of the mission is to be made here next week. The project is probably unique in the annals of trade, but the result, apparently, is going to prove the efficacy of a direct appeal from the business men of one nation to those of another. It was a statesmanlike move, but then Mr. Arthur Balfour during the war period proved himself over and over again to be capable of carrying through important business of the State—particularly on one occasion in Italy, though of that matter I cannot write without revealing secrets. Should this meet his eye, however, he will understand, no doubt.

Shipbreakers and the Admiralty.

Speaking at the meeting of shareholders in Thos. W. Ward, Limited, held here a few days ago, Mr. Joseph Ward had some very interesting things to say. For the first half of the year the company's turnover was nearly three millions sterling, and for the year it was over four millions. The whole of the firm's twelve shipdismantling works, together with all its other works, as far as possible, gave full employment to the company's men during the strike. From the Admiralty, the directors had bought a block of 118 battleships, cruisers and destroyers. Mr. Ward said he considered the English shipbreaker was not having fair treatment at the hands of the Government at the present time. Notwithstanding the large amount of unemployment, ships were being sold to foreign countries, where the wages were about half, and they had now to meet the competition of this material coming back to the country at a cheaper rate. Notwithstanding these troubles, however, the company appears to have come through the slump period remarkably well, for the directors were able to declare a dividend for the year of 10 per cent., tax free, and it may be of interest to add that £70,000 of the capital is held by employees. Mr. Ward says the firm is prepared to stand any further trade shock that may come.

The Fuel Position Relieved.

It is some little time now since I took an opportunity of dealing with the coal position from the market point of view, but there are features of it which may be of particular interest at the moment, and it may be here mentioned that readers who follow the Sheffield coal quotations on The Engineer's "Current Prices" page will observe that this week several substantial changes have been made in the figures. These changes are not to be taken as indicative of a collapse of that section of the market, but simply an attempt to revise the quotations in such a way as to make them approximate to the levels of business actually being done, though the prices given must still be regarded as more or less nominal, for there appears to be considerable variation in values. The fact is that since work was resumed at pits on July 4th, the prices at collieries of the various qualities of fuel have been very wide, but now there seems to be some approach toward stabilisation, so that it is possible to give approximately correct dealing prices. Some very substantial reductions have taken place in manufacturing fuels, but chiefly in slacks and coke, the price of the latter having been lowered by as much as 20s. a ton. There are still some cheap lines of inferior qualities of small fuels on offer at special rates, but, taken altogether, nothing like the same amount of selling pressure exists as was the case a few weeks ago. In many instances stocks under load at pits have been very considerably reduced, in spite of the fact that better time has been worked in the mines recently. For example, at one colliery there were nearly 600 wagons under load a month or so ago, and to-day there are something like 100 wagons on order. To some extent this condition of affairs has been brought about by the restarting of coke ovens, while increased exports have also been of material assistance in reducing stocks. Then, too, many industrial concerns have bought more freely of late, particularly special lots, and at a number of works stocks are being accumulated as a precaution against possible trouble with the miners when the latter have to face the substantial wage reductions which it is expected will operate as from November 1st. However, there are fuel stacks still to be seen at a good many pits, and until more coke ovens are put into commission it cannot be expected that the market will be cleared.

Watch for "Current Prices" Changes.

Efforts are being made to get the miners' leaders to agree to loading in the pit with forks and riddles, but they are very reluctant to give up a concession that was obtained really under compulsion. Since shovel loading was introduced at the beginning of 1918, the percentages of small fuels produced have greatly increased, and although latterly they have not, perhaps, been quite as high, they are greatly in excess of those of pre-war days. From the commencement of the war up to the beginning of 1918, although forks and riddles were supposed to have been used in the pits, there is no doubt a considerable tonnage was loaded with shovels—a practice which was at that time winked at by managements in view of the acute scarcity of fuel. Shovel loading, of course, was equivalent to a substantial wage advance to coal-face workers, for it is quite obvious that a far larger tonnage can be loaded with infinitely less labour with shovels than with forks and riddles. Another reason for the increased fuel demand is the fact that a fair number of furnaces have been put into blast again, though it must be added that up to a week or so ago the inland demand for coke was not sufficiently large to take up the whole of the production. As a result of the active demand for export, however, the market has changed very rapidly. Prices have already hardened, and it is expected they will go very much higher during the next month or two. At the moment, the demand is chiefly from Italy and the Scandinavian countries. It is unnecessary, perhaps, to carry the matter further at present, but, as already explained, the changes made this week with the Sheffield coal section of The Engineer's "Current Prices" page are intended to show current actual dealing rates for ordinary day-to-day business, though in some instances, of course, special sales are made at arranged rates. From this date onward the list should be watched for variations on the lines laid down.

General Conditions.

Just a few concluding lines on the general trade position, though no great change has occurred since last I wrote on it. Very slowly the position is improving, and I hear of firms that have been running their works a few days on alternate weeks now preparing for a return to full time. Some of the crucible works, too, are reporting better conditions, fair orders for mining and other steel having come to hand from some of the Colonies. The transactions in bright drawn steel bars, which I mentioned as having been reported lately down to as low as £12, were for continental material, it appears, the regular figure here still being up at £20, though it seems quite likely a lower quotation may be heard of very soon. The break-up of the iron pipe makers' "ring" bears out my suggestion of a week ago, that the day of "rings" is passing, and more may be heard of these matters later on. About thirty steel furnaces have now been put into commission in this district, but while that fact is gratifying, the number does not represent one-third of the total furnaces here. Steel prices continue to tend downwards, though there is still an appreciable margin between home and foreign quotations, but the latter are inclined to rise, and deliveries are bad. Some of the merchant houses here are passing through very embarrassing times, being squeezed between the British customer who cancels his order for consignments of foreign iron or steel, made to specification, because delivery is not given within the agreed time, and the foreign maker, who refuses to allow the merchant to repudiate the business, however delivery may be delayed. One merchant in a large way in continental business told me this week that he is absolutely afraid to open his correspondence of a morning.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

There is still no break in the gloom which enshrouds the Cleveland iron trade. The whole outlook is utterly cheerless. Makers cannot afford to sell foundry iron at lower rates, and they even seem to doubt whether there would be any substantial improvement in the demand if pig iron could be sold at 100s. Confidence is entirely lacking, and without confidence there can be no business. Buyers might be inclined to come forward more freely if they were sure of stabilised prices, but values are tending downwards, and they are not likely to do more in the present circumstances than cover their immediate needs. Then, again, the foundries are all either idle or slack, and they are buying minimum quantities of local iron and in some cases mixing it with cheap foreign stuff. Thus the position shows no improvement on the week, and the only encouraging feature is that good medium blast-furnace coke is now offered at 32s. 6d. per ton delivered at the works. This is a drop of about 2s. 6d. per ton, and although the ironmasters will not pay even that price, it indicates a narrowing of the gap between buyers' and sellers' ideas. There is occasionally a little No. 1 Cleveland foundry iron available at 125s., and small parcels of No. 3 can be bought at 120s. per ton for home consumption, although 5s. more is asked to cover loading charges if the iron is sold f.o.b. for export. No. 4 foundry is freely offered at 119s. per ton, No. 4 forge and mottled at 117s. 6d., and white iron at 115s. per ton.

Hematite Pig Iron.

There is only a limited market at home for East Coast hematite pig iron, and still less demand from abroad. The output now considerably exceeds the demand, and makers are eager for orders at 130s. for mixed numbers and 132s. 6d. per ton for No. 1.

Manufactured Iron and Steel.

The position in the manufactured iron and steel trade is very discouraging. Works that are carrying on are only doing so on hand-to-mouth orders, and a big proportion of the plant in this district is completely idle. Home orders are very scarce indeed, and competition for foreign contracts is keen, although the guarantee of delivery is a point in favour of the British manufacturer. Still, our prices are high compared with those quoted by continental producers, and whilst British makers are prepared to cut quotations for foreign business, it is held that home prices must also fall further. Meanwhile, the recent level of home prices is maintained.

Rapid Fall in Prices and Wages.

Wages and prices in the iron and steel trade of the North of England continue to be subjected to a drastic cutting-down process. The report of the accountants to the Board of Conciliation and Arbitration for the Manufactured Iron and Steel Trade for the two months ending August 31st shows that the net selling price was £16 13s. 4.77d., as compared with £19 3s. 8.19d. in the preceding two months, a drop of £2 10s. 3.42d. Under the sliding scale arrangement, the wages of puddlers and other forge and mill workers are reduced by 25 per cent. The production for the two months by the affiliated firms reached 3688 tons, as compared with 255 tons in May and June. The rapid fall in prices since the beginning of the year is reflected in the following returns:—

	£	s.	d.
January and February	26	19	7.97
March and April	24	1	1.48
May and June	19	3	8.19
July and August	16	13	4.77

Wages have been reduced as follows:—

January 31st	5 per cent.
March 31st	25 per cent.
May 30th	30 per cent.
August 1st	47½ per cent.
September	25 per cent.

Thus, since the beginning of the year wages have fallen 132½ per cent., and are now only 97½ per cent. above the standard.

Iron and Steel Exports.

The exports of pig iron, manufactured iron and steel from the Cleveland district during September showed a gratifying increase, although they were considerably below the normal. The most striking improvement occurred in the exports of finished material, which amounted to 36,279 tons, as compared with 22,097 tons in August, an increase of 14,182 tons. Of the total, 5058 tons went coastwise, and 31,221 tons abroad. India took 11,062 tons, Nigeria 3784 tons, New Zealand 3082 tons, Portuguese East Africa 2918 tons, Cape Colony 2459 tons, the Argentine 2316 tons, and Australia 1263 tons. The shipments of pig iron totalled 7560 tons, as compared with 6116 tons in August

Heavy Imports.

Foreign competition, however, is exceedingly keen, and considerable quantities of iron and steel continue to pour into the district from Germany, Holland, Belgium, France and Norway. Month after month the import of pig iron has grown until in September it reached the enormous figure of 20,320 tons, as compared with 12,302 tons in August, and only 15 tons in September, 1913. During the past eleven months, no less than 57,783 tons of pig iron have been shipped into the Cleveland district from abroad, compared with 1080 tons in the corresponding period of 1912–13. Importations of steel during the same period showed a small decrease. During the eleven months, 28,323 tons of billets, blooms, slabs, &c., were imported, compared with 38,667 tons, and 20,191 tons of plates, bars, rails, sheets, &c., compared with 22,023 tons.

The Coal Trade.

The Northern coal trade position is unimproved, and as a rule business is as slack as ever, while the forward prospects present very little ground for optimism. The whole situation is disappointing, not so much from want of inquiries, which come along more or less regularly for both large and small quantities, but from the fact that so little results from the efforts of exporters. They

generally send their lowest quotations forward, but only very occasionally is an order booked, while in most cases counter offers when they are made are at prices which cannot possibly be entertained. Matters are, therefore, allowed to slide until the market becomes more favourable. The home market trade is also very quiet, with the demand for all classes of coal steadily diminishing, while the output is constantly being curtailed, either by working short time or closing the collieries entirely for the present. The steam coal trade is dull, with the exception of smalls, which, being scarce by reason of the restricted demand for screened sorts, are firm at top figures. Otherwise very little is being done. Gas and coking coals are neglected for the most part, while the bunker trade is exceedingly slow. There is not much change in the coke market. Foundries are quiet, but gas coke is in good request, and is firm in price.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE returns from the Clyde shipbuilding yards for the month of September are higher than recent months and well up to the average for the same month in preceding years. This improvement, however, is not the outcome of a revival in trade, but is mainly explained by the resumption of work by the shipyard joiners. The increased output is composed chiefly of vessels held up during the joiners' strike, which, in the ordinary course of events, would have been launched long ago. The returns for September, amounting to sixteen vessels of 50,152 tons aggregate, is the third highest this year. The total for this year to date is 181 vessels of 350,016 tons, compared with 166 vessels of 489,425 tons in the same period last year. Chief amongst the launches were the twin-screw motor ship Duiteldijk, of 9500 tons, for the Holland-America Line, Rotterdam; the turbine steamer Madura, of 9500 tons, for the British India Steam Navigation Company, London; and two steamers of over 7000 tons, one for Messrs. Alfred Holt and Co., Liverpool, and the other for Dutch owners. Prospects are still very obscure. In spite of the reductions in wages and materials, builders are unable to quote prices low enough to induce owners to consider the placing of new tonnage. Present costs of building are estimated to be about twice the current price of tonnage. In any case the shipping outlook meantime does not warrant the construction of new boats, as many large steamers are still lying up owing to the lack of cargoes. There is little optimism amongst owners, who generally anticipate a continuance of present conditions for a few months at least.

Unemployment.

Despite all efforts to stem the tide of unemployment, each week adds its quota to the number of those seeking relief because of lack of work. The position in Lanarkshire, where steel and iron works and collieries are either closed down or on short time, is becoming steadily worse. Some pits have never re-started since the strike, while some which did re-start have been forced to close down again for an indefinite period. Upwards of 7000 miners are out of work, and the majority of the others are only getting three days' work in the week. Steel and iron works are hardly any better off. The majority of the miners in Ayrshire are working three to four days per week, but in the Lothians and Fifeshire a considerable amount of unemployment prevails.

The Outlook.

Generally speaking, there seems little hope of improvement on this side of the New Year holidays. Labour troubles on the Continent are retarding deliveries, and local makers hoped to benefit thereby, but consumers evidently prefer to do without materials rather than pay home prices. Costs are certainly decreasing, but, as has often been said, a large and not a slow measure of reduction is absolutely necessary to hold out any hope of trade. Fuel is cheaper, but other costs prevent manufacturers from taking advantage of this fact. Order after order is lost, and little or nothing gets past the inquiry stage. A drop in miners' wages in view of the price obtained for coal is inevitable, and it remains to be seen if coal will cheapen further at present. Wages in the manufactured iron trade also are falling, but in other branches of industry employees are haggling over decreases of about 10s. to £1 per week, and in the meantime are losing pounds per week in wages, with the additional risk of total unemployment. Producers everywhere have struggled to keep works going in the hope of a sudden turn for the better, and have received little in the way of encouragement. Recent indications promise plenty of business when costs are compatible with consumers' resources. Meantime County Councils and Corporations are formulating schemes to absorb those who would be otherwise employed at greater profit to themselves and the country in general if a reasonable standard or basis of wages was universal.

Steel and Iron.

Steelmakers are doing very little at present, and new business has remained at almost vanishing point. Plates, sheets, hoops, strips, &c., are all easier in price, but the market is dull in the extreme. Export is practically dead, and small steamers have to clear with very light cargoes. Bar iron makers have booked a few orders of late, but these are of small account, and have little effect on the works in general. The present basis price of £14 per ton is still about £6 per ton above continental quotations, and little hope can be entertained of much business.

Pig Iron.

Pig iron moves off very slowly. Outputs are not large, but the market is very weak. An additional furnace will be put in operation this week, however.

Coal.

During the past week nothing of fresh interest occurred in the Scotch coal trade. Despite the reduction in employment, the output is evidently still in excess of requirements, and collieries find great difficulty in disposing of stocks. All descriptions of fuel, with the exception of nuts, are extremely quiet. Industrial and house coal demands are weak in spite of the moderate prices ruling. Good shipping orders, too, are very scarce, and only steamers of small tonnage are in demand. A certain amount of business has been done with Balkan and French ports, but the bulk of the turnover is for coastwise dispatch. Fair inquiries from the Mediterranean are reported. Notwithstanding the severe cuts in prices, however, consumers abroad show little inclination to deal on a large basis. Freights are weakening, however, and this fact may help matters.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

A RATHER nervous feeling prevails in South Wales coal trade circles concerning the future, not only as regards business, but with respect to the relations between capital and labour. The developments of last week between the coalowners and the Mines Department anent the proportion of the wages cost for September to fall on the former, created no little uneasiness and disturbed business. Instead of the situation having improved, the position is that things are worse for the reason that now the coalowners are in disagreement with the miners leaders regarding the wages for this month. Coalowners and shareholders in colliery undertakings are feeling far from comfortable, because October has been entered upon with coalowners weighted down with a probable deficit of approximately £300,000 in respect of September, apart from which it is not known definitely what the wages cost for the current month is to be. Moreover, the inquiry from abroad is negligible, even at prices which represent a loss of several shillings per ton. So far as the coalowners and the Mines Department are concerned, on the question of the wages for September, interviews took place at the end of last week in London, but the Mines Department adhered firmly to its view that the percentage on the 1915 rates to be borne by the coalowners should be 97.57 and not 46.34, while the coalowners' representatives put forward their claim that their liability was 72.6 per cent., which tallies with the view of the miners' leaders. However, as the matter was considered to be of a very important character, it was decided that a full meeting of South Wales coalowners should be called for Monday last to consider the situation, and whether the offer of the Mines Department to submit the matter to arbitration should be accepted. The meeting of the coalowners on Monday accepted the course proposed by the Mines Department, and agreed that Sir William Plender should be asked to give his interpretation of the national agreement so far as it affects the question in dispute as to the percentage for which the owners are liable in September. Sir William Plender agreed to see the parties on Wednesday, the 5th inst.

October Wages.

A graver question, however, is that relating to the miners' wages for the current month. Members of the Conciliation Board discussed on Monday the percentage payable for October, but there was no agreement forthcoming between the coalowners' representatives and the miners' leaders. The report of the joint accountants as to the proceeds and costs in the month of August and the percentage payable to the workmen as from the 1st inst. was before the meeting. This certificate, which was based on Clause 4 of the National Agreement, certified that the percentage was 51.68 per cent. on the 1915 standard rates, but the workmen's representatives claimed that the October wages should be on the basis of the proceeds of the industry for July and August, and that therefore the percentage payable on the 1915 standard rates should be 112.81, which they submitted was in accordance with the interpretation of Clause 11 (9) of the national wages agreement given by Sir William Plender, the independent chairman of the National Wages Board. The owners suggested without prejudice that the percentage for October should be fixed provisionally at 51.68, pending a decision by the National Board, and that should the Board grant any increase, it should be made retrospective to October 1st. The men's leaders, however, were entirely opposed to this course. They considered that reference to the National Board was unnecessary to establish their claim to the 112.81 per cent. on the 1915 standard rates, and consequently there is a deadlock. Miners' leaders are explaining the situation at district and other meetings of the workmen, and there is to be a meeting of the Executive Council of the South Wales Miners' Federation later in the week. According to one of the men's leaders, this meeting will decide what action shall be taken to enforce their claim. He calculates that if the owners only pay 51.68 per cent. on the 1915 standard rates, this will mean a reduction of 4s. 5d. per day to the collier on the minimum wage, 4s. 2d. to the haulier, and 4s. 2d. to the labourer. Such wages, he says, will be definitely refused, and it will inevitably mean the breaking up of the agreement.

What Can the Industry Stand?

The question, of course, arises as to what is the ability of the industry to meet the men's demands. The owners contend that should they be compelled to pay 112.81 per cent. during October, they will be forced to shut down the majority of their collieries. The grave position in which the industry is placed is shown by the fact that according to Mr. Vernon Hartshorn, the well-known miners' leader, coal prices must go up rather than come down, and yet there is no appreciable buying of South Wales coals, even at current figures. Mr. Hartshorn has recently dealt with the question of costs of production, and he estimates that the cost of putting a ton of coal free on board throughout September was not less than 33s. 6d. He adds that it is practically certain that every ton of coal raised in the South Wales coalfield during September has been sold at a loss, and that coalowners cannot sell coal at the prices quoted during September. Mr. Hartshorn points out that if the foreign buyer continues to hold off, he will not get the coal any cheaper, and the only possible result will be the closing of additional collieries and more unemployment.

Current Business.

Unfortunately for the coal trade, foreign buyers are not to be coerced into buying coals at any price, and it is significant of the lack of perturbation abroad at the developments of a week ago, when coalowners suddenly raised their prices 2s. 6d. to 5s. per ton, that before the week was out colliery salesmen were simply forced to lower their prices again. The demand for coal has been negligible, and coal exporters are in anything but a happy frame of mind. The lack of stability in the market caused by alarms and disputes is doing infinite harm to business. Sellers cannot quote for business with any feeling of security that something will not happen to upset all their quotations, and probably mulct them in a loss, while buyers abroad are equally averse to buying when prices are mercurial, as they may be similarly placed in facing a loss, should a competitor by delaying purchasing for twenty-four or forty-eight hours secure his coals at a lower figure. The fact is that the market is so irregular that values cannot be adequately given.

Employment.

In some cases collieries which have been idle have been able to resume, an instance of this being Messrs. D. Davis and Son's Ferndale and Tylorstown pits, where 8000 men are employed; but, on the other hand, others have had temporarily to close. In the steel and tinplate industries, operations have been resumed at more works. Two thousand men restarted on day-to-day contracts at the Dowlais Steel Works, while at Swansea the Villiers Spelter Works are running, after being at a standstill for many months. These are the only spelter works in South Wales which are working, and, according to the management, they are able to resume owing to wage concessions and other circumstances.

Shipping Facilities.

Repair work on the railway viaducts leading to the tips on the west side of the East Dock at Cardiff having been completed, the working of the tips, which have been put in order, was resumed on Monday last. There are five tips on the west side of the East Dock, each with a loading capacity of 300 to 400 tons per hour. Work is also nearly finished on the renewal of two high-level tips, with a capacity of 500 to 600 tons per hour. These appliances will be especially useful for the bunkering of large light vessels. One is likely to be ready this month. Coalowners and shipowners are pleased at the work being carried out, as it was needed and will facilitate loading. The saving of time means money, and frequently all the difference being a profit and a loss on a voyage.

Latest News from the Provinces.

NORTH OF ENGLAND.

Further Reduction in Prices.

THE lower qualities of Cleveland pig iron, which have been quite a drug on the market for a long time past, have been reduced by 5s. per ton, No. 4 forge becoming 112s. 6d., and mottled and white iron 110s. per ton. Heavy steel rails are also 30s. per ton cheaper at £12 10s. per ton.

WALES AND ADJOINING COUNTIES.

French Marine Contracts.

The French naval authorities have purchased supplies of Welsh coal on a c.i.f. basis, for delivery over the remainder of the year. The quantity of best Admiralty large purchased is reported to be about 50,000 to 60,000 tons, while firms with fuel works in France are understood to have sold the French marine about 100,000 tons of smalls to be shipped from this district.

INSTITUTE OF TRANSPORT.

THE following awards have been made in respect of the years 1919–20 and 1920–21 by the Institute of Transport:—

Railway Gold Medals.—Operating: Arthur Watson, C.B.E., M. Inst. T., General Manager, London and North-Western and Lancashire and Yorkshire Railway, for paper on "Some Advantages of Control as Applied to Traffic on Railways." Engineering: William George Bishop, M. Inst. T., Superintendent (Mechanical), South African Railways, for paper on "Locomotive Shed Practice on the South African Railways."

Road Transport Gold Medal.—Colonel C. H. Bressey, O.B.E., M. Inst. T., Divisional Engineer, Roads Branch, Ministry of Transport, for paper on "History of Roads, Constructional Requirements from the User Point of View, Systems of Control, and Taxation of Road User."

Aerial Transport Gold Medal.—Major-General Sir Frederic Hugh Sykes, G.B.E., K.C.B., C.M.G., Controller-General, Civil Aviation, for paper on "Aviation and Air Transport."

Graduate Medal.—William Frederick Steel, London and South-Western Railway, for paper on "Potato Traffic from St. Malo to Southampton Docks."

Student Medal.—Carol Vaughan Miller, Great Eastern Railway, for paper on "Freight Train Loading in relation to Economic Working."

"*Modern Transport*" *Premium.*—John Whitehead Parker, Lancashire and Yorkshire Railway, for paper on "The Use of Trays as a Means of Reducing Goods Handling."

Congress at Olympia, October 17th, 1921.—At the invitation of the promoters of the Commercial Vehicle Exhibition, the Institute will hold a congress at Olympia on Monday, October 17th next, when a paper on "Highway Maintenance and Administration under Modern Traffic Conditions," by Mr. A. E. Brookes, O.B.E., M. Inst. T., Engineer, Surveyor and Architect to the Durham County Council, will be read at 11 a.m.; and a paper on "The Evolution of the Motor Vehicle for Goods and Passenger Service," by Mr. Percy Frost Smith, M. Inst. T., at 2.30 p.m.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	37/-
[1] Spanish	28/-
[1] N. African	28/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	28/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—[2]		
Hematite	7 15 0	—
No. 1 Foundry	7 10 0	—
No. 3 ,,	7 5 0	—
N.E. Coast—		
Hematite Mixed Nos.	6 10 0	6 10 0
No. 1	6 12 6	6 12 6
Cleveland—		
No. 1	—	—
Silicious Iron	—	—
No. 3 G.M.B.	6 0 0	6 0 0
No. 4 Foundry	5 19 0	5 19 0
No. 4 Forge	5 12 6	5 12 6
Mottled	5 10 0	5 10 0
White	5 10 0	5 10 0
Midlands.		
Staffs.—		
All-mine (Cold Blast)	17 0 0 to 17 7 6	
Part Mine Forge	*None offering.*	
,, Foundry No. 3	*None offering.*	
Northampton *(Delivered Midlands).*—		
Foundry Nos. 2 and 1	*Nominal.*	
,, No. 3	6 5 0 to 6 10 0	
,, Forge	*Nominal.*	
Derbyshire [3] *(All nominal).*—		
No. 3 Foundry	6 10 0	—
Forge	6 0 0	—
Lincolnshire—		
Basic	*Uncertain.*	
Foundry	,,	
Forge	,,	
N.W. Coast—[4]		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	7 5 0	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	14 0 0	—
Best ,,	17 0 0	—
N.E. Coast—		
Common Bars	14 0 0	—
Marked ,,	18 0 0	—
Tees	14 10 0	—
Lancs.—		
Crown Bars	14 0 0	—
Hoops	17 5 0	17 0 0
S. Yorks.—		
Crown Bars	16 0 0	—
Best ,,	17 0 0	—
Hoops	17 5 0	—
Midlands—		
Marked Bars (Staffs.)	20 0 0	—
Crown Bars	16 0 0	—
Nut and Bolt Bars	15 10 0 to 16 0 0	
Black Sheets (dbls. nom.)	17 0 0 to 17 10 0	
Galv. Sheets, 24 W.G. (f.o.b. L'pool, or equal)	20 0 0	—
Gas Tube Strip	17 10 0	—

STEEL.

	Home.[6] £ s. d.	Export.[7] £ s. d.
Scotland—[5]		
Boiler Plates	19 0 0	—
Ship Plates ¾in. and up	14 0 0	—
Sections	13 10 0	—
Steel Sheets ⅛in. to ¾in.	15 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	24 0 0

STEEL (continued)

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	14 0 0	14 0 0
Angles	13 10 0	13 10 0
Boiler Plates	19 0 0	19 0 0
Joists	13 10 0	13 10 0
Heavy Rails	12 10 0	—
Fish-plates	19 0 0	—
Channels	14 10 0	—
Hard Billets	11 0 0	—
Soft Billets	9 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	14 0 0	—
Light ,,	16 0 0 to 18 0 0	
Billets	13 0 0	—
Ship Plates	14 0 0	—
Boiler ,,	20 0 0	—
Manchester *(Prices irregular and uncertain, unchanged)*—		
[8] Bars (Round)	12 0 0 to 14 0 0	
[8] ,, (others)	13 0 0 to 15 0 0	
Hoops (Best)	17 5 0	17 0 0
,, (Soft Steel)	14 5 0	14 0 0
Plates	£12 to 14	12 0 0
,, (Lancs. Boiler)	19 0 0	
Sheffield—		
Siemens Acid Billets	16 0 0	—
Bessemer Billets	15 10 0	—
Hard Basic	11 0 0	—
Soft ,,	8 10 0 to 10 0 0	
Hoops	14 5 0	—
Soft Wire Rods	13 15 0	—
Midlands—		
Small Rolled Bars	11 10 0 to 13 0 0	
Bessemer Billets and Sheet Bars	7 10 0 to 8 10 0	
[2] Hoops	14 0 0	—
Tube Strip	12 0 0 to 13 0 0	
Angles and Joists	13 10 0	—
Tees	14 10 0	—
Bridge and Tank Plates	14 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	20/6 to 22/-
Block Tin (cash)	156 10 0
,, (three months)	158 10 0
Copper (cash)	68 12 6
,, (three months)	69 10 0
Spanish Lead (cash)	23 5 0
,, (three months)	23 2 6
Spelter (cash)	26 10 0
,, (three months)	27 0 0
Manchester—	
[9] Copper, Best Selected Ingots	70 10 0
,, Electrolytic	73 10 0
[10] ,, Strong Sheets	103 0 0
,, Loco Tubes	0 1 2½
Brass Loco Tubes	0 1 0½
,, Condenser	0 1 4½
Lead, English	24 5 0
,, Foreign	23 5 0

(Metal prices practically unchanged).

FERRO ALLOYS.

(All prices now nominal).

	Per Ton.	Per Unit
Tungsten Metal Powder	1/9 per lb.	
Ferro Tungsten	1/6 to 1/8 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£29	12/-
,, 6 p.c. to 8 p.c. ,,	£27	12/-
,, 8 p.c. to 10 p.c. ,,	£27	12/-
,, Specially Refined		
Max. 2 p.c. carbon	£79	28/-
,, 1 p.c. ,,	£94	32/-
,, 0·75 p.c. carbon	£110	41/-
,, carbon free	2/8 per lb.	
Metallic Chromium	5/6 per lb.	
Ferro Manganese (per ton)	£18 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£12 10 0 scale 5/- per unit	
,, ,, 75 p.c.	£20 0 0 scale 6/- per unit	
,, Vanadium	22/- per lb.	
,, Molybdenum	9/- per lb.	
,, Titanium (carbon free)	1/6 per lb.	
Nickel (per ton)	£190	
Cobalt	14/6 per lb.	
Aluminium (per ton)	£110 to £120 (British Official).	

FUELS.

	Export.
Scotland.	
Lanarkshire—	
(f.o.b. Glasgow)—Steam	24/6
,, ,, Ell	26/-
,, ,, Splint	26/- to 30/-
,, ,, Trebles	28/6
,, ,, Doubles	26/6
,, ,, Singles	23/-
Ayrshire—	
(f.o.b. Ports)—Steam	24/6
,, ,, Splint	26/-
,, ,, Trebles	28/6
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	21/- to 25/-
Screened Navigation	32/-
Trebles	28/-
Doubles	25/-
Singles	23/-
Lothians—	
(f.o.b. Leith)—Best Steam	22/-
Secondary Steam	21/-
Trebles	28/6
Doubles	26/-
Singles	23/-
England.	
[11] N.W. Coast—	
Steams	42/-
Household	56/6 to 60/-
Coke	37/6 to 42/6
Northumberland—	
Best Steams	27/6 to 30/-
Second Steams	25/- to 27/-
Steam Smalls	15/- to 17/6
Unscreened	22/6 to 27/-
Household	30/- to 35/-
Durham—	
Best Gas	29/-
Second	25/- to 27/6
Household	30/- to 35/-
Foundry Coke	45/- to 55/-
Sheffield—[12]	
S. Yorks. Best Steam Hards	32/- to 33/-
Derbyshire Hards	31/6 to 32/-
Seconds	30/6 to 31/6
Cobbles	30/6 to 31/6
Nuts	28/- to 30/-
Washed Smalls	17/- to 18/-
Best Hard Slacks	17/6 to 18/6
Seconds ,,	17/- to 17/6
Soft Nutty ,,	17/- to 17/6
Pea ,,	11/6 to 12/6
Small ,,	9/- to 10/-
House, Branch	40/- to 41/-
,, Best Silkstone	37/6 to 39/-
Blast Furnace Coke (Inland and Export)	25/- to 30/-
[13] South Wales.	
Cardiff—	
Steam Coals:	
Best Smokeless Large	30/- to 31/-
Second ,, ,,	29/- to 30/-
Best Dry Large	30/- to 31/-
Ordinary Dry Large	25/- to 27/6
Best Black Vein Large	27/6 to 28/6
Western Valley ,,	27/6 to 28/6
Best Eastern Valley Large	26/- to 27/6
Ordinary ,, ,,	25/- to 26/-
Best Steam Smalls	19/- to 20/-
Ordinary ,,	10/6 to 18/-
Washed Nuts	30/- to 32/6
No. 3 Rhondda Large	30/- to 32,6
,, ,, Smalls	19/- to 21/-
No. 2 ,, Large	25/- to 26/-
,, ,, Through	20/- to 22/6
,, ,, Smalls	15/- to 16/-
Coke (export)	60/- to 65/-
Patent Fuel	29/- to 31/-
Pitwood (ex ship)	35/- to 37/6
Swansea—	
Anthracite Coals:	
Best Large	55/- to 57/6
Seconds	52/6 to 55/-
Red Vein	47/6 to 50/-
Big Vein	55/- to 57/6
Machine-made Cobbles	70/- to 72/6
Nuts	70/- to 72/6
Beans	57/6 to 60/-
Peas	30/- to 32/6
Breaker Duff	9/6 to 10/6
Rubbly Culm	13/6 to 14/6
Steam Coals:	
Large	29/- to 31/-
Seconds	28/- to 29/-
Smalls	12/6 to 14/-
Cargo Through	20/- to 22/6

[1] Delivered. [2] Net Makers' works. [3] At furnaces. [4] Delivered Sheffield. [5] Glasgow, Lanarkshire and Ayrshire. [6] Home Prices—All delivered Glasgow Station.
[7] Export Prices—F.O.B. Glasgow. [8] Prices represent the real market before the *official* change was made. [9] These prices are practically alike now.
[10] Sheets reduced while other prices are advancing. [11] Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export.
[12] For inland sales. [13] Per ton f.o.b.

French Engineering Notes.

(From our Correspondent in Paris.)

Port Equipments.

The economical situation in France generally is not favourable to industrial enterprise of any kind, but the various Chambers of Commerce are fully aware that the countries which prepare for the recovery, when it comes, will reap the greatest benefit, and, aided by the Government, a good deal of work is being carried out at the ports for dealing with a much larger volume of traffic than is possible at present. After obtaining her share of the ships surrended by Germany, as well as the large tonnage conceded by Great Britain, France became the third maritime Power, and, in view of the programme of colonial development, it has been found necessary to provide the means of utilising this merchant fleet, which will, moreover, extend its operations to South America, and more especially to the extreme East. Considerable harbour extensions are now in progress at Havre, Marseilles and elsewhere, and at all the ports a large amount of elevating and other machinery is being laid down. During the past week the Minister of Public Works paid an official visit to Bordeaux to inspect the installations that have been put down recently, notably the grain elevators and cold storage plants and machinery for rapidly unloading colliers. Except for Calais, Dunkirk and Havre, where much was done to increase the harbour facilities during the British occupation, nearly all the ports were until recently lacking in the necessary material, and even at Havre the considerably increased tonnage imported at a time when fuel and commodities had to be purchased abroad obliged the local Chambers of Commerce to prepare a vast scheme of extension which is now being put in hand. The work cannot progress very rapidly on account of the shortness of funds, but much is already being done, and there is no doubt that in time the home merchant fleet will be in a position to deal with the bulk of the foreign and colonial trade.

The Rhone Barrage.

The preliminary work being carried out in view of the execution of the Rhone hydro-electrical scheme is making satisfactory progress. The most difficult part of the undertaking will be the Genissiat barrage, which is to have a height of nearly 100 m., and which it was feared might be imperilled by possible fissures in, and the supposed permeable character of, the underlying chalk strata. For nearly two years past an elaborate system of soundings has been in progress. First, a shaft was sunk at the side of the river to a depth of 50 m., and then a horizontal gallery was driven to the other side. A second horizontal gallery was driven just underneath the bed of the river, and borings were made upwards to the old bed. From the lower gallery borings were effected to ascertain the profile of the rock stratum. This work proved that the foundation for the barrage would be perfectly sound. It is hoped that with the termination of the preliminary work it will be possible to proceed with the constitution of the Compagnie Nationale du Rhône, which does not appear to be making so much headway as had been expected, first, on account of the financial situation generally, and then because public opinion was influenced by reports that the scheme would present serious technical difficulties.

Hydro-Electrical Schemes.

The carrying out of hydro-electrical schemes in the Savoie is providing some interesting engineering problems, which are being satisfactorily solved. A characteristic example is the work undertaken by the Société de la Haute-Isère, which has driven a tunnel, 6400 m. long, through Mont-Pourri in order to make available at Sainte-Foy-en-Tarentaise a 400 m. head of water. The tunnel and the barrage, which is at an altitude of more than 1000 m., are nearly completed, and it is expected that the power plant will be installed by the end of the present year, so that it can be put in operation next spring. The power station at Sainte-Foy-en-Tarentaise will produce an average of 40,000 horse-power, of which two-thirds will be supplied to Lyons and one-third to Saint-Etienne. The current will be distributed under a tension of 120,000 volts over a distance of 225 kiloms. Up to now this is by far the most important electrical distribution scheme carried out in France.

Reconstruction.

If the work of reconstruction carried out with the aid of the State has been paralysed by lack of funds, the repairing and equipment of works and factories have, nevertheless, made satisfactory headway, the more so in view of the great difficulties under which manufacturers have had to labour, particularly in connection with the Comité d'Achats, the operations of which could hardly be expected to give general satisfaction. The Committee was not in a position always to supply manufacturers with just the machinery they required, and until they were authorised to place orders direct, many of them preferred to pay for what they purchased, so as to be sure of obtaining the machines they needed. The Comité d'Achats certainly accomplished useful work in coming to the aid of firms which had to reconstruct their factories; but a great deal was done privately, and since the Committee has had practically no more funds to dispose of, everything has had to be done by private initiative or by the public loans, which, it is to be feared, have not been in all cases successful. Nevertheless, marked progress continues to be made, and on September 1st an official inquiry elicited replies from 3824 firms in the devastated areas which had resumed operations, either wholly or partly. In 1914 there were 4805 works, each with more than twenty men, and employing a total of 835,298 hands. The number of hands engaged on the reconstructed works at the time of the inquiry was 397,985, or a little more than 47 per cent. of the previous total. Of the 3824 factories in operation, 806 are employing the full number of hands, and 1528 between 50 and 99 per cent. Each month shows a steady improvement, but it will probably take a considerable time before the devastated areas have recovered their normal industrial activity

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

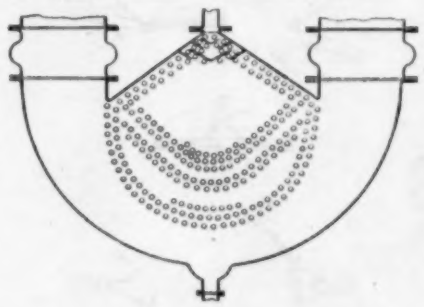
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

159,210. February 20th, 1920.—Surface Condensers, *Metropolitan-Vickers Electrical Company, Limited*, 4, *Central-buildings, Westminster, Assignees of Henry Frederick Schmidt*, 1312, *Elm-street, Wilkinsburg, late of Strath Haven Inn, Swarthmore, Pennsylvania.*

In this condenser there are two exhaust steam inlets and between them there is a raised portion of the shell, at the top of which the air pump connection is made. The condensate is

N°159,210



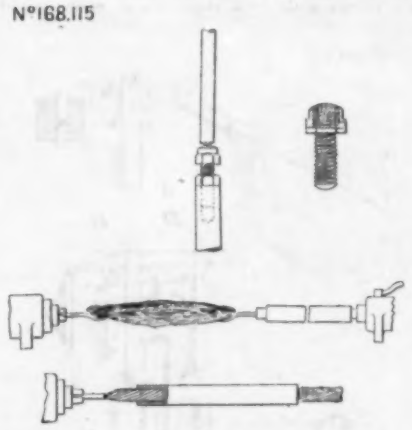
drawn off at the bottom in the usual manner. The circulating water passes first through the tubes in the upper part of the condenser, in order to cool, as far as is possible, the uncondensable vapours going to the air pump.—*September 1st*, 1921.

INTERNAL COMBUSTION ENGINES.

168,115. May 13th, 1920.—Valve Tappets, *The British Thomson-Houston Company, Limited*, 83, *Cannon-street, London, E.C.* 4.

In order to deaden the noise made by the valve gear of internal combustion engines the inventors fit the tappets with studs of compressed fibres, such as asbestos or cotton. The fibres are

N°168,115



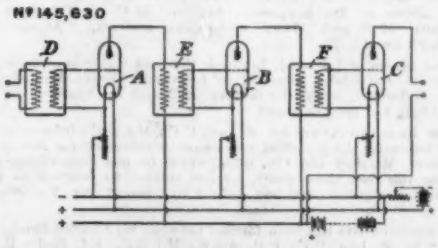
first twisted as shown and are covered with a metal sheath. The sheath is then swaged down in diameter and cut up into lengths for the studs. A stud is shown in the upper view.—*August 15th*, 1921.

WIRELESS TELEGRAPHY.

145,630. June 30th, 1920.—Improvements in Thermionic Tube Electro-magnetic Wave Amplifying Arrangements, Gesellschaft für Drahtlose Telegraphie, M.b.h' Tempelhofer Ufer 9, Berlin, S.W., Germany.

In using thermionic tubes or valves for the amplification of weak alternating currents of audible or inaudible frequency, it has usually been necessary to limit the arrangement to one or at the most two such tubes in cascade connection. Attempts

N°145,630

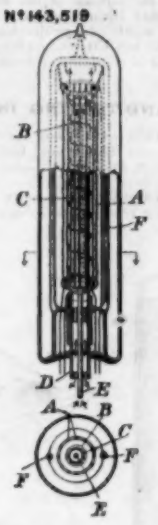


to use more than two tubes have led to difficulties. An arrangement of this sort has been found to be very sensitive to the electro-magnetic waves usually present in space, and with a view to eliminating the trouble, copper or other sheetings are used over the coupling transformers. In the drawing A, B and C are thermionic relays, arranged in cascade connection, and D, E, F the iron core transformers which are sheathed by metal cases.—*September 1st*, 1921.

143,519. May 17th, 1920.—Improvements in or relating to Thermionic Devices, The Western Electric Company, Limited, Victoria Embankment.

The evacuated glass tube contains, as usual, three electrodes, a filament A, a grid B, and an anode C. The latter is in the form of a metallic tube connected to the exterior of the bulb by a glass tube D, the arrangement being such that the inner surface of the anode tube can be kept in contact with a cooling medium,

N°143,519



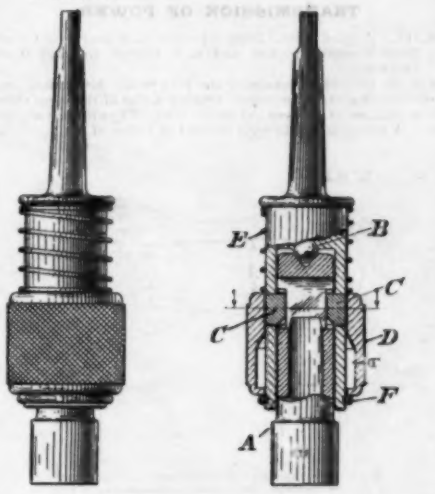
so as to prevent the anode from becoming heated by the electronic bombardment from the cathode. A pipe E communicates with the interior of the anode tube, and the cooling medium circulates through and outside the tube, as indicated by the small arrows. Glass supports are shown at F.—*August 17th*, 1921.

MACHINE TOOLS AND SHOP APPLIANCES.

168,270. November 5th, 1920.—Drill Chucks, R. J. Austin, 1, Hill-street, Birmingham, and P. B. Newell, 51, Strenchamroad, Cannon Hill, Birmingham.

In this drill chuck the collet A for holding the drill is centred by the ball B and is engaged by segmental pads C C bearing on

N°168,270



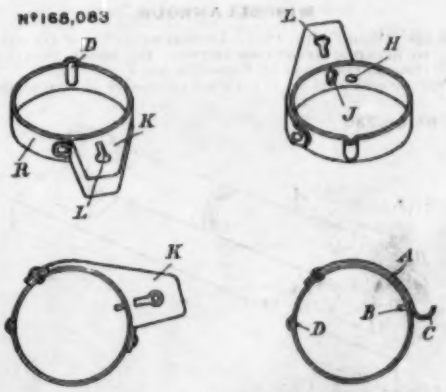
flats. These pads are held in the driving position by the sleeve D, which, in turn, is held by the spring E. A stop for the sleeve is provided by the split ring F.—*September 1st*, 1921.

LIGHTING AND HEATING.

168,083. September 30th, 1920.—Improvements in and relating to Electric Lamp Holders, The British L. M. Ericsson Manufacturing Company, Limited, of 5, Chancery-lane, W.C. 2, Herbert Heath Hayes, of 6, Meadow-road, Beeston, and Albert Archibald Godfrey, of 28, Holgate-road, Nottingham.

This invention relates to improvements in electric lamp

N°168,083



holders of the type in which the lamp is held firmly locked after insertion and cannot be removed except by an authorised person who has a key. A ring R slips over the outside of a bayonet type

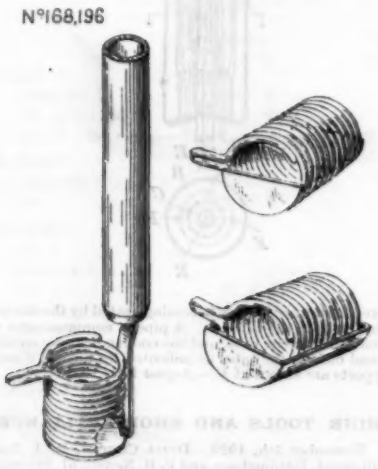
of lamp holder, and has a recess D on the inner side. One pin of the lamp fits into this recess D and the other pin into a slot H. A spring A is riveted to the ring R, so as to actuate a projecting piece B, which passes through a slot J, and is adapted to drop into a separate hole or slot pierced in the bayonet socket holder when the lamp is in position, thus preventing the removal of the lamp until the spring is raised to release the locking projection. In practice, this hole could be pierced in the holder by means of a suitable hand tool. A cover K is preferably fitted over the spring A on the outside of the ring, the cover being provided with a key hole L through which a key may be inserted. The key engages with wards or a projection C on the spring A, so that when turned the key lifts the locking projection B clear, and allows the removal of the lamp.—*August 18th*, 1921.

MEASURING AND TESTING INSTRUMENTS.

168,196. June 19th, 1920.—Pens for Recording Apparatus, Nalder Brothers and Thompson, Limited, 97A, Dalston-lane, London, E.C. 8, and W. G. Laird, 13, Finsbury Park-road, N. 4.

The inventors use a tightly coiled helix of wire to form the ink container of pens for recording instruments. The bottom of

N°168,196



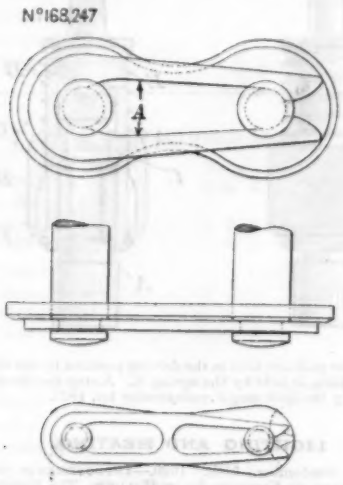
the helix is closed by a plate. The ink finds its way up the wire to the marking point by capillary attraction. It is said that the pen may be used in either a horizontal or vertical position.—*September 1st*, 1921.

TRANSMISSION OF POWER.

168,247. August 26th, 1920.—Joints for Driving Chains, Hans Renold, Limited, and A. E. Carter, Burnage Works, Didsbury.

For the purpose of retaining the pins in the detachable joints of driving chains the inventors employ a clip of the form shown, which engages in grooves cut in the pins. The clip has an opening at A large enough to pass the end of either of the pins. It is

N°168,247



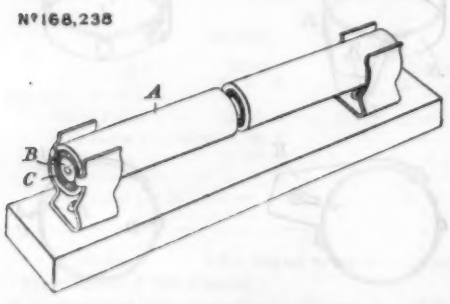
put in place by being dropped over one pin and then moved endways, when the two free ends spring out and engage the other pin. For long-pitch chains a bridge is provided in the clip as shown in the lower view.—*September 1st*, 1921.

MISCELLANEOUS.

168,238. August 11th, 1920.—Improvements in or relating to Electric Resistance Devices, The British Thomson-Houston Company, 83, Cannon-street, E.C.

This invention relates to electrical resistances which comprise

N°168,238

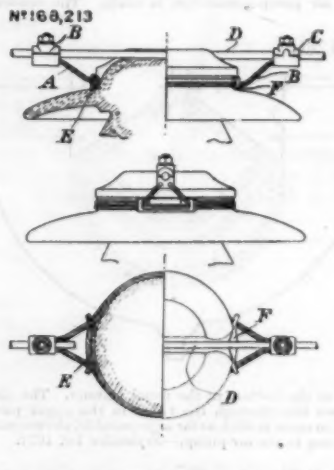


a mass of finely divided conducting material, and its object is to provide a resistance device which has a substantially constant resistance. A tubular shell A of ductile metal, such as iron or copper, is provided with a coil B, which is also composed of ductile metal. Between the core and the shell is a packed layer of resistance material consisting of cuprous oxide Cu_2O, cupric oxide CuO, silicon, silicon carbide, magnetite or other material having a marked negative thermal coefficient of resistance. The material is packed into the tube, and the diameter of the tube is reduced and its length increased by swaging or rolling. Whilst this is being done plugs are used at the ends of the tubes to prevent loss of the resistance material. The swaging or rolling process uniformly compresses and packs the resistance material between the case or shell, and produces intimate contact between the particles. Preferably a resistance made in the manner described is divided into two parts, which are connected in series through the core and a convenient method of doing this is to cut out a section of the shell A and the resistance layer B in a lathe.—*September 1st*, 1921.

168,213. June 30th, 1920.—Improved Means of Fixing Conducting Wires to their Insulators, Carlo Romagnoli, of Corso Magenta, 31, Milan, Italy.

The method of fixing wires to insulators in accordance with this invention will readily be understood from the accompanying drawing, where A and B are two flexible rings of wire or a metal cable having the ends fixed to two clamps B and C, which are also made fast to the line conductor D. It will be seen from

N°168,213

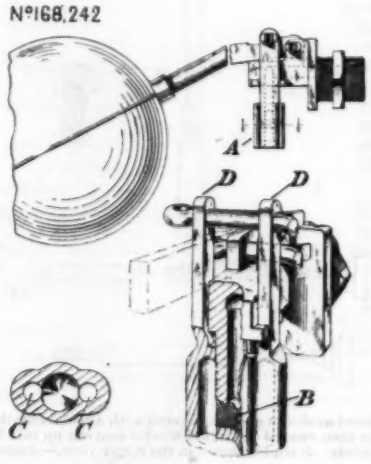


the drawings that the ends of one ring terminate in the clamp B and those of the other ring in the clamp C. The wire rings are maintained in position on the insulator with the aid of plates E and F, having openings through which the ends of the cables forming the rings are passed.—*September 1st*, 1921.

168,242. August 14th, 1920.—Ball Cocks, A. G. Parks, 13, Forest-road, Tunbridge Wells.

The object of the inventor has been to devise a ball cock which will be more conveniently assembled in awkward places than is the case with the usual pattern. He thus places both the pin joints at the top of the cock, where they are easily accessible.

N°168,242



The valve A, it will be seen, embraces the outlet and has a washer fitted at B. Passage for the water is provided by the holes C C breaking into the central bore. Two arms D D extend upwards from the valve and, together with a split pin, form a stirrup over the float lever.—*September 1st*, 1921.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

The Spearing Boiler Company, Limited, has moved into new offices at 20, Kingsway, London, W.C. 2. Telephone, Holborn 5740 and 5741; telegraphic address, "Arcturus, Estrand, London."

The offices of Lactocol, Limited, the cold water glue manufacturers, have been removed to 1, Central House, Wembley Hill, Middlesex, while the factory at 2 and 2a, Studley-road, Stockwell, has been enlarged.

Mr. Leonard Andrews, M. Inst. C.E., M.I.E.E., informs us that following the practical conclusion of the work for Messrs. Johnson, Matthey and Co., upon which he has been engaged during the past three years, he has started to practice as a consulting engineer, and has opened an office at 104, Victoria-street, S.W. 1.

A partnership has been formed between Sir Charles Bright, F.R.S.E., M. Inst. C.E., F.R. Ae. S., M.I.E.E., F.I. Radio E., M. Inst. T.; Mr. A. Hugh Seabrook, M.I. Mech. E., M.I.E.E., consulting engineer (late Chief Engineer and General Manager to the St. Marylebone, London, and other electric supply undertakings); Mr. A. J. Stubbs, M. Inst. C.E., M.I.E.E. (late Assistant Engineer-in-Chief, H.M. Post Office); and Lieut.-Col. H. W. Woodall, C.I.E., M. Inst. C.E. (Director and Consulting Engineer of gas and water companies), under the style of Sir Charles Bright and Partners, consulting engineers, with offices at 146, Bishopsgate, E.C. 2.

Forthcoming Engagements.

TO-DAY.

Manchester Association of Engineers.—Memorial Hall, Albert-square, Manchester. Inaugural address by the President, Mr. Fred. J. West. 7 p.m.

The Institution of Locomotive Engineers (London).—Visit to the works of the Broughton Copper Company, Manchester. Meet at the entrance of the works at 2.15 p.m., which are situated in Silk-street, Blackfriar-road, Manchester. After the visit the first general meeting will be held at the Victoria Hotel, at 5 p.m., when a paper on "Notes on Axle-boxes and Horn Blocks," by Mr. A. E. Kyffin, will be read and discussed.

The Junior Institution of Engineers.—39, Victoria-street, Westminster. "Colour Vision and Colour Blindness," by Dr. Edridge Green. 8 p.m.

SATURDAY, OCTOBER 8TH.

Association of Engineers-in-Charge.—Holborn Restaurant, London. Twenty-first annual dinner. 6 p.m.

North of England Institute of Mining and Mechanical Engineers.—Wood Memorial Hall, Newcastle-on-Tyne. Presidential address by Mr. C. C. Leach. Paper open for discussion, "The Carbonisation of Coal and Low Temperatures," by Mr. John Roberts. 2 p.m.

MONDAY, OCTOBER 10TH.

Institute of Transport.—Victoria Hall, Hotel Cecil, London, W.C. 2. Second Institute Dinner. 7.30 p.m.

Institution of Automobile Engineers: Loughborough Graduates.—Room 119, The College, Loughborough. "Tests on the Efficiency of a Six-cylinder Aero-engine," by Mr. W. P. Johnson. 7 p.m.

University of London.—University College. Public lecture, "Einstein's Theory of Relativity," by Dr. G. B. Jeffery. 5 p.m.

TUESDAY, OCTOBER 11TH.

Engineering Golfing Society.—Sandy Lodge Golf Course. Autumn meeting. 10 a.m.

Sheffield Association of Metallurgists and Metallurgical Chemists.—Royal Victoria Hotel, Sheffield. "The Hardening of Tool Steels," by Mr. S. N. Brayshaw. 7.30 p.m.

Institute of Metals: Birmingham Local Section.—Chamber of Commerce, New-street, Birmingham. Chairman's address, by Dr. H. W. Brownsdon. 7.30 p.m.

Institute of Metals: Scottish Local Section.—Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. Chairman's address on "Modern Aspects of Scientific Metallurgy," by Professor J. H. Andrew, D.Sc. 7.30 p.m.

TUESDAY AND WEDNESDAY, OCTOBER 11TH AND 12TH.

Institution of Gas Engineers.—Central Hall, Westminster. Annual general meeting. For programme see page 372. 10 a.m. each day.

WEDNESDAY, OCTOBER 12TH.

Royal Sanitary Institute.—90, Buckingham Palace-road. Discussion on "Plumbing and Sanitation on Board Ship." 4 p.m.

Institution of Automobile Engineers.—Royal Society of Arts, John-street, Adelphi, W.C. 2. Ordinary general meeting. Presidential address, "Industrial Standardisation," by Mr. Geo. W. Watson. 8 p.m.

Institution of Mechanical Engineers: North-Western Branch.—Visit to spinning and weaving mills of Ashton Bros., Hyde, 10 a.m. Visit to textile machinery works of Platt Bros., Limited, Oldham, in the afternoon.

The Newcomen Society.—Institute of Marine Engineers, The Minories, London, E.C. Paper, "History of Continuous Conveying Devices," by Mr. G. F. Zimmer. 5 p.m.

THURSDAY, OCTOBER 13TH.

Institute of Metals: London Local Section.—Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C. 3. Chairman's address, by Dr. O. F. Hudson. 8 p.m.

Royal Aeronautical Society.—Library, 7, Albemarle-street, W. 1. Discussion for student members on a paper, "A Comparison of Different Types of Aerofoils," by Mr. T. A. Kirkup. 7 p.m.

FRIDAY, OCTOBER 14TH.

Junior Institution of Engineers.—Caxton Hall, Westminster, S.W. 1. Paper, "Electric Cranes," by Mr. C. H. Woodfield. 8 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Lecture Theatre of the Mining Institute, Neville-street, Newcastle-on-Tyne. Presidential address by Sir Wm. Joseph Noble, Bart. 6.30 p.m.

Electro-Harmonic Society.—The Great Hall, Cannon-street Hotel. First smoking concert. 8 p.m.

MONDAY, OCTOBER 17TH.

Institute of Transport.—Institution of Civil Engineers, Great George-street, S.W. 1. Presidential address by Sir Henry P. Maybury. 5.30 p.m.

WEDNESDAY, OCTOBER 19TH.

Thornycroft Engineering Society.—J. I. Thornycroft and Co., Limited, Works Canteen, Basingstoke. "Comparative Motor Cycle Performances," by Mr. D. S. Heather. 7 p.m.

FRIDAY, OCTOBER 21ST.

Institute of Transport.—Royal Society of Arts, John-street, Adelphi, W.C. 2. Lecture for graduates and students, "Water Transport—Coastwise Shipping of the United Kingdom," by Mr. M. Salt. 5 p.m.

Junior Institution of Engineers.—Caxton Hall, Westminster, S.W. 1. Lecturette, "Pyrometry for Boilers: Some Questions, Pertinent and Impertinent," by Mr. C. E. Foster. 8 p.m.

WEDNESDAY, OCTOBER 26TH.

Institution of Automobile Engineers.—Royal Automobile Club, Pall Mall, S.W. 1. Annual dinner. 7.30 p.m.

Contracts.—Among the recent orders received by Sir William Arrol and Co., Limited, for "Temperley" transporters for coal handling there are a tower transporter for the Azores, some portable transporters for Plymouth, while two tower transporters of a capacity of 100 tons per hour each are in hand for the L.C.C. power station, Greenwich. Some large bridge transporters for a coaling station in West Africa are also in course of construction,